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EVALUATION OF THE ORGANIZATIONAL STRUCTURE AND MANAGEMENT PRACTICES OF THE CALIFORNIA DEPARTMENT OF TRANSPORTATION

VOLUME II: DETAILED FINDINGS, OPTIONS, AND RECOMMENDATIONS

Prepared for:

CALIFORNIA LEGISLATURE
Legislative Analyst's Office
925 L Street, Suite 690
Sacramento, CA 95814

Attn: Dana Curry, Project Director

Prepared by:

Gerald W. Bernstein, Director
Transportation and Operations Practice
SRI International

Gabriel Roche, Inc.
Oakland, California

Vernazza Wolfe Associates, Inc.
Oakland, California

333 Ravenswood Avenue • Menlo Park, CA 94025-3493 • (415) 326-6200 • FAX: (415) 326-5512 • Telex: 334486

CONTENTS

ILLUSTRATIONS

TABLES

GLOSSARY

AASHTO	American Association of State Highway and Transportation Officials
A&E	architect and engineering
ADTs	average daily trips
BT&H	Business, Transportation and Housing
CADD	computer-aided design and drafting
CASE	computer-aided systems engineering
CAFE	corporate average fuel efficiency
CEQA	California Environmental Quality Act
CHP	California Highway Patrol
CPI	consumer price index
CTC	California Transportation Commission
C/O	capital outlay
CTP	California Transportation Plan
DBE	Disadvantaged Business Enterprise
DGS	Department of General Services
DPA	Department of Personnel Administration
DIS	Division of Information Services
DMV	Department of Motor Vehicles
DOT	Department of Transportation
DVBE	Disabled Veteran Business Enterprise
EEO	Equal Employment Office
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FCR	Flexible Congestion Relief
FHwA	Federal Highway Administration
GIS	geographic information systems
GPS	global positioning systems
HOV	high occupancy vehicles
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
IVHS	Intelligent Vehicle Highway Systems
LAO	Legislative Analyst's Office
LFP	labor force participation
MBE	Minority Business Enterprise
MIS	management information systems
MPO	metropolitan planning organization
MSA	merit salary adjustment
MVA	Motor Vehicle Account
NEPA	National Environmental Policy Act
OTS	Office of Traffic Safety
PCE	preliminary and construction engineering
PE	professional engineer
PECG	Professional Engineers in California Government
PM	project manager

PMCS	Project Management Control System
PSR	Project Study Report
PTMS	Public Transportation Facilities and Equipment Management System
PYEs	person-year equivalents
PYs	person-years
QC/QA	quality control and quality assurance
RFP	Request for Proposal
ROW	right of way
RTPA	regional transportation planning agencies
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SHA	State Highway Account
SHOPP	State Highway Operation and Protection Plan
SSRA	Seismic Safety Retrofit Fund
STA	State Transportation Assistance
STIP	State Transportation Improvement Program
TEIS	Transportation Executive Information System
TMA	transportation management areas
TP&D	Transportation Planning and Development Account
TRAMS	Transportation Accounting Management System
TSM	Traffic Systems Management
VLF	Vehicle License Fee
VMT	vehicle miles of travel
WBE	Women Business Enterprise

INTRODUCTION

OVERVIEW

This management audit of Caltrans consisted of four steps: an assessment of the department's current performance (the findings), an identification of options to improve performance where appropriate, development of a plan for improving Caltrans' performance, and development of an implementation plan that identifies the specific steps necessary to carry out the preferred plan. These efforts are directed toward improving the positioning of Caltrans in state government, the department's organizational and management structure, and its project delivery performance—in short, creating a more efficient and effective Caltrans.

This volume presents details of the findings, options, and recommendations that the SRI International project team developed following its review of Caltrans' performance. An implementation plan focusing on the high-priority recommendations is also described.

We have organized our findings so as to facilitate discussion of the major problems and of the recommendations that can address them. The project team has focused on the issues raised in SCR72, the LAO Request for Proposal (RFP), our assessment of issues raised by interviewees, and other guidance such as comments from the Steering Committee. Other auditable activities (such as a financial audit of Caltrans' budget) are omitted as beyond the scope of this evaluation.

The options outline alternative courses of action that our experience indicates could alleviate the problem(s) identified in the finding. Specifically, we have attempted to introduce improvements in efficiency and effectiveness, leadership, accountability, and responsiveness to stakeholders. In some cases multiple, mutually exclusive options could be pursued. In other cases only a single course of action would result in any change. Remaining with the status quo is always an option, of course; we therefore have not separately identified it as an option.

Some options also recur as solutions to general management problems and to problems specific to project delivery. Strengthening performance measures, improving capital outlay support accountability, and improving PYPSCAN, for example, address problems arising within overall department management as well as within the specific area of project delivery. In cases such as this, recommendations may be repeated, but are cross-referenced to one another.

The recommendations reflect our assessment of the course of action that will lead to the greatest improvement in efficiency and effectiveness at Caltrans. Our recommendations seek improvements in leadership and management, introducing changes that go beyond actions allowed by the current rules and statutes under which Caltrans operates. We believe that changes to these rules and statutes are needed to change its "rule-driven" to a "product-driven" orientation. We promote increased competition between Caltrans and private sector providers as a means of improving the department's efficiency and lowering its costs. We have also sought to maintain internal consistency among the recommendations developed.

Our implementation plan has two elements. The first is a series of actions needed to implement our 14 key recommendations. We believe that action is needed on these

recommendations (as a minimum) if any significant change is to be effected. The second element is an alternative action plan if it becomes apparent after approximately 2 years that the initial implementation plan will not produce the desired results, yet concerns with Caltrans' inefficiencies and ineffectiveness continue.

We have divided the areas of focus established in SCR72 into seven specific categories for analysis similar to those we have used to evaluate other government agencies and private sector businesses. These seven are policy, organization, overall management and leadership, financial management, human resources management, management information systems, and project delivery. While addressed separately, the problems and solutions are not as easily divisible. These categories are closely linked; for example, implementation in the project delivery area cannot be achieved without also addressing leadership, human resources, and management information system problems.

Policy and Positioning. Our attention to policy focuses on the high-level establishment and integration of goals and procedures that influence Caltrans, which arise outside the department, yet which directly shape the department's environment and thereby influence its actions. Policy issues themselves are not a main focus of the study, but we have explored those whose impacts on Caltrans' management practices are significant. These issues cannot typically be resolved or answered with information or technical understanding; policy in this sense is "value judgment" that only officials such as legislators, governors, or judges, not technical experts, are entitled to make.

Organization. We use the term "organization" to denote the structure of offices, their responsibilities, and the relationships through which the Caltrans director pursues his or her policies. This use also encompasses both the headquarters appointments in Sacramento and those in the 12 districts.

Overall Management and Leadership. This category addresses the overall planning and management of the department, including its ability to establish goals and to see them through to implementation. "Leadership" is the articulation and consistent pursuit of a coherent set of principles and strategies to guide conduct during the period of appointment of a particular Caltrans director.

Financial Management. Because this evaluation is intended as a management (distinct from a financial) audit, financial management issues are not a major theme. In its typical usage, "financial management" denotes the activities involving the flow of funds from sources to the payment of expenditures, such as engineering management or construction. The financial issues investigated herein are those that have arisen in relationship to other identified management issues and problems.

Human Resources Management. "Human resources management" includes Caltrans activities that involve recruiting, deploying, terminating, and retiring appropriately trained individuals who perform the functions required by statute and policy and announced by department leadership. General statutory requirements, such as the regulations commonly known as civil service rules, as well as contractual arrangements with various bargaining units of state employees, significantly affect Caltrans' management of these functions. Contracting out is also a human resources management issue.

Management Information Systems. "Management information systems (MIS)" denotes the structure, content, and processes employed to apply information technology within Caltrans. MIS includes personnel, hardware, and software associated with computer systems, as well as various manual formats and routines. Financial management systems, human resources management systems, and project management systems are all part of the broader management information system and are sometimes discussed separately under these categories.

Project Delivery. "Project delivery" denotes the strategies, systems, and organizational arrangements that Caltrans employs to manage projects under its statutory authority. This section focuses on the process of delivering (that is, preparing) projects for advertising for construction bids. Because this activity is one of the core areas of Caltrans' efforts, the evaluation reviews many elements of organization, leadership, human resources management, and MIS needs in the project delivery context.

The assessment of Caltrans' performance entailed many steps: analyses of data; a literature search, including a review of prior reports, audits, and selected studies; and extensive interviews. During the study, the project team interviewed almost 200 persons within Caltrans and outside the department to develop our perspective on the problems and issues that the department faces, as well as perspectives on how these might be addressed. We obtained data to support points when they have permitted quantification. The organizations interviewed are summarized in Table I-2 of Volume I of this report.

CALTRANS IN PERSPECTIVE

"Caltrans has come light-years." A sales tax county transportation authority executive

"Caltrans is the classic immovable object." An engineering firm executive.

Caltrans has many images, some contradictory. At times during the interview process, team members paused to determine whether they were discussing the same organization they had discussed the day (or hour) before with a different respondent. Many interviewees expressed frustration with aspects of Caltrans' performance (which led to this study), while others provided many examples of positive, professional behavior.

In general, Caltrans operates according to rational and well-conceived policies and procedures; according to one interviewee familiar with practices in several states, "California is way ahead in bringing fiscal responsibility into highway programs." Funding for transportation in California follows the best practices nationwide—the sources and uses of funds are clear and generally closely related to one another. Checks and balances exist to maintain accountability of budgeting and expenditures.

Staff members take pride in their professional attainments and the rich tradition of the department. Caltrans senior management is aware of the need to be responsive to change and is already working to address several of the issues raised in SCR72 and the RFP. Constraints to more rapid organizational change include the structure of state government with its many rules and regulations. While designed to prevent abuses, these laws also serve to make implementation of change more difficult. The combination of established procedures and an able staff lead to a stable system and predictable decision making.

Frequent favorable comments were made statewide regarding the performance of the current director, James van Loben Sels, equally from persons inside and outside the department. His

efforts to restore a mission and direction to Caltrans, his attempts to address long-standing problems that have been allowed to linger, and his initiation of a dialogue and meetings with stakeholders and partners are all well received.

Many critics of the department also recognize that problems attributed to Caltrans (such as lengthy environmental reviews) are many times, in fact, due to circumstances not under the department's control. For example, Caltrans also acts as the statewide representative of the Federal Highway Administration (FHwA), and therefore needs to impose federal standards and procedures for any project using federal funds. The agendas and goals of other organizations and their personnel can frustrate the best efforts to coordinate and partner.

Despite Caltrans' credible efforts, however, our findings identify areas where significant attention is warranted to improve operating efficiencies and to improve relations with partners and other stakeholders. Progress is being made in small steps, but we believe much larger strides are needed for Caltrans to effectively fulfill its responsibilities.

Not all solutions are within Caltrans' purview, but Caltrans can provide more leadership than it has to effect the desired results in some key areas. The basic issue is whether Caltrans has the wherewithal and commitment to do so. Given the constraints within which it operates and the lack of significant progress on previous initiatives, SRI is concerned that leadership and a substantial commitment to pursue solutions are lacking—both inside Caltrans and at the policy-setting level. At this point, then, it is useful to establish the context within which Caltrans currently operates and the major transportation forces of the future.

CHANGING ROLES IN TRANSPORTATION REQUIREMENTS, FUNDING, AND PROJECT INITIATION

CALTRANS AS AN INTEGRAL PART OF A BROAD TRANSPORTATION BASE IN CALIFORNIA

Travel and transportation are a major activity and expense for California citizens and businesses. In 1989, the private sector (individuals and businesses) and public entities spent between $40 billion and $60 billion on transportation goods and services in the state. These expenditures support our mobile lifestyles and business enterprises and include such diverse individual items as the purchase of a car or light truck, the purchase of freight services from trucking companies and railroads, passenger tickets purchased on common carriers, and government expenditures on the public transportation system. The latter includes both capital and operating components such as infrastructure elements (e.g., highways, ports, airports, and vehicles), equipment (e.g., buses and light rail vehicles), consumables, and salaries.

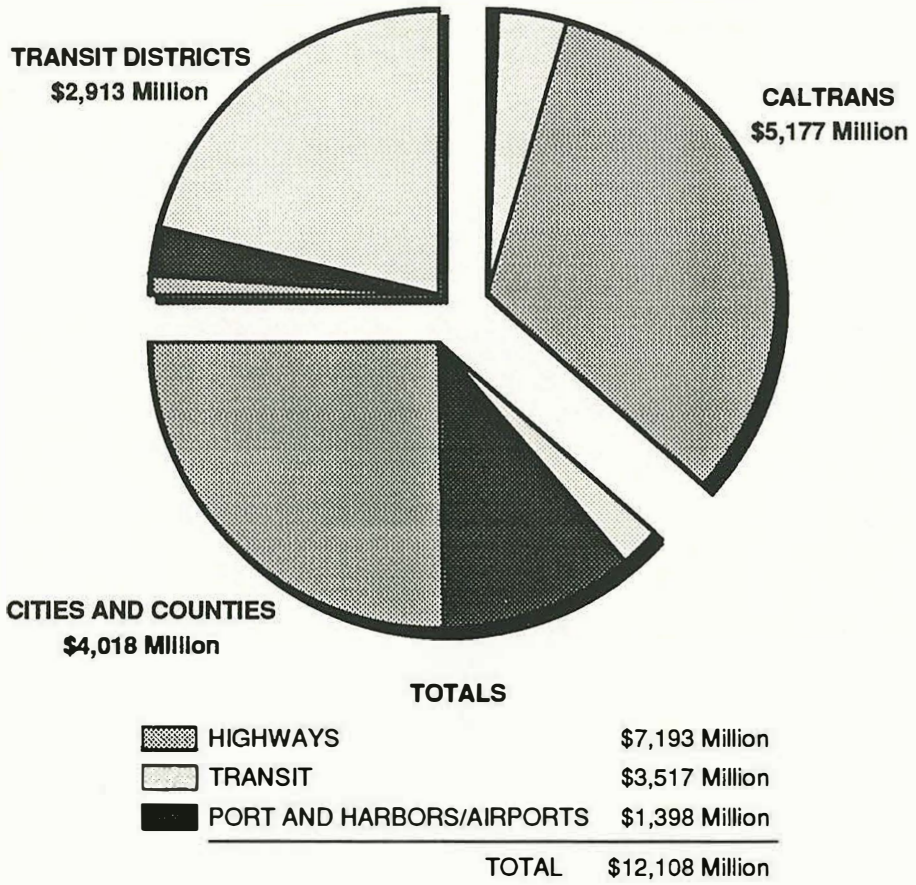
Within the government sector, the major entities involved in transportation include the state government (Caltrans), local (city and county) governments (including special measure districts), and transit districts. Collectively, these entities spent $12.1 billion on transportation in FY1991/1992 (see Figure II-1).

For many years, the principal transportation objective for the state was construction and maintenance of highways and streets. In 1973, when the Division of Highways became the Department of Transportation (Caltrans), this goal changed. Nevertheless, funding for alternatives to highways was still extremely limited; with few exceptions—such as state support for additional intercity rail service in the Los Angeles/San Diego corridor, state control of the Peninsula Commute Service, and administration of transit grants to rural areas—the role of Caltrans remained primarily focused on the highway function.

Leadership in urban and commuter-rail related expenditures (operating and capital) rests with the transit districts. In this domain, the role of Caltrans and local government entities, although significant in generating funds, is still of lesser magnitude. Indeed, until the 1970s, the state had virtually no involvement in local public transit. For intercity service, however, Caltrans' leadership is more active; state support is provided for the *San Diegans* and the *San Joaquins*, and the department is supporting the High Speed Rail Commission (established in December 1993).

Leading in expenditures for seaports and airports are the counties that own them. Here, too, the state role in funding is (and historically has been) small relative to local and user funding.

Significantly, Caltrans' role has historically been very modal specific and not uniformly significant. Although new roles for the department are considered, the roles and responsibilities of other government entities must be recognized. Caltrans needs to build consensus with these other entities (and private sector participants) on its appropriate role in nonhighway transportation development efforts.



Source: Caltrans

FIGURE II-1 TOTAL STATEWIDE TRANSPORTATION FUNDING PERSPECTIVE (FY1991/1992)

Most recently, the public has become increasingly aware that the state's transportation needs are vast, particularly in urban areas experiencing ever-worsening problems of congestion and air pollution. As a consequence, the ways in which transportation projects are defined, initiated, and funded are changing in response to revised mandates from local, state, and federal jurisdictions. The principal differences are as follows:

- Traditionally, state and federal gasoline taxes had been the primary funding source. Now, additional sources of funding for transportation projects (such as sales taxes and special-purpose public bonds) are available.
- Local and regional governments are taking a greater role in establishing project priorities.
- The issues of highway expansion now include considerations of other factors, such as improved system operations, rehabilitation, mitigation enhancements, and other modes, primarily rail.
- The number of state and federal regulations with which Caltrans must comply is larger.

- The constituency for planning and approving projects has broadened considerably.

New Transportation Agencies and Funding Sources

Until almost 1980, Caltrans was the primary public entity that funded, initiated, designed, and managed construction of state highway projects. Since that time, several changes have affected Caltrans' role and have introduced additional players in transportation project planning and funding. These include the county transportation authorities, the federal Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), and the State Transportation Blueprint Legislation, including Propositions 108, 111, and 116. These three innovations are discussed below. Caltrans continues to be the lead organization responsible for project management.

County Transportation Authorities. In the mid-1980s, the state legislature passed enabling legislation so that county governments (through a vote of the electorate) could increase the sales tax for a variety of local programs, but primarily transportation improvements. The 0.5% increase in the sales tax could be spent on a variety of transportation improvements, including transit, maintenance, and Caltrans projects. The duration of the special sales tax programs ranges from 10 to 20 years. Approximately 20 counties in the state—representing 85% of the population—have now created special transportation programs. These represent most of the major urban counties as well as several smaller counties.

The projects that comprise special transportation authority programs vary. In some instances, the focus is on major capacity-increasing highway projects that would normally be under the responsibility of Caltrans. By using special measure funds, local governments can accelerate programming and speed up the design and construction process. In other instances, funds are not used for Caltrans projects but primarily for transit and local public works projects.

Those transportation authorities that use special measure funds for Caltrans-related projects have established a close working relationship with Caltrans because it is involved every step of the way. These projects must meet the same planning and design standards as other Caltrans projects. One of the advantages of special-measure-funded projects is the ease of contracting out. Transportation authorities can enter into contracts directly, thereby reducing delays in negotiating and processing contracts. Caltrans staff are still involved in overseeing consultants, however, and, in some counties, have directly contracted with the authorities to provide planning and design services.

Transportation Blueprint and 1990 Ballot Measures. In June 1990, California voters approved three major ballot measures intended to increase funds available for transportation projects—Propositions 108, 111 (also referred to as the key element of the Transportation Blueprint for the 21st Century), and 116.

- *Proposition 108* is the Passenger Rail and Clean Air Bond Act. It authorized a $1 billion bond issue to provide funds for acquisition of rights-of-way, capital expenditures, and acquisitions of rolling stock for intercity rail, commuter rail, and rail transit programs. Money from the California General Fund is appropriated to pay off bond principal and interest.
- *Proposition 111* is the Traffic Congestion Relief and Spending Limitation Act of 1990. It establishes a new statewide traffic congestion relief program and

updates spending limits on state and local governments more generally. Revenues to relieve traffic congestion are raised via increases in truck weight fees and increases in the state gasoline and diesel tax. Traffic congestion relief revenues can be spent on state highways, local streets and roads, and public mass transit facilities. This measure also created the county congestion planning process, which mandates consideration of land use and congestion mitigation in the project selection process and encourages bottom-up project selection planning as opposed to top-down planning.

- *Proposition 116* is the Clean Air and Transportation Improvement Act, an initiative that supplemented state-initiated components of the *Blueprint*. Passed in 1990, it authorizes $2 billion principally for passenger and commuter rail systems and mass transit guideways, with some funding for rural transit projects and bicycle and ferry facilities. These funds are to be allocated by the California Transportation Commission (CTC) to state and local entities. Some local matching funds are required. The state's General Fund pays the principal and interest for bonds issued to raise the funds.

The Transportation Blueprint for the 21st Century (as well as the Proposition 116 initiative) acknowledged that California's transportation system was no longer adequate. To address the problems of traffic congestion, it provides funds over the next 10 years to implement a multimodal transportation program. Although previous state plans had emphasized the role of highways to meet additional demand, the *Blueprint* proposed to increase capacity through a multimodal approach, a departure from prior policy. As cited above, the *Blueprint* also changed the way in which state and regional transportation planning and development decisions would be shared, by increasing the decision-making role of the regional transportation planning agencies (RTPAs). This shifting of responsibility reflected the understanding that congestion is a local and regional issue.

Intermodal Surface Transportation Efficiency Act of 1991. The hallmark of ISTEA is the availability of federal gasoline tax revenues and other highway-related user tax revenues to support a broader range of transportation-related uses than before its enactment. Formerly, these funds were restricted for highway use. Under ISTEA, state and local governments have more flexibility in transportation planning, since they can use federal funds for a broader range of projects, such as transit, rail modernization, metropolitan transportation planning, operations, and research and technology designed for the 21st century.

ISTEA further strengthened the responsibility of metropolitan planning organizations (MPOs) for planning and project selection. In addition, direct federal funding is available to MPOs redirecting portions of funds that previously had flowed through local governments (cities and counties). Areas with more than 200,000 inhabitants are designated as transportation management areas (TMAs). Many types of projects planned for these areas are to be selected by MPOs in consultation with local governments and Caltrans. Furthermore, any capacity-increasing projects located in TMAs that do not meet federal clean air standards for ozone and carbon monoxide must be part of an approved congestion management system. Because MPOs generally are responsible for congestion management, this aspect of ISTEA provides them with considerable authority in approving new Caltrans projects designed to increase capacity. Outside of urban areas, Caltrans has the lead role.

Increase in Regulations

Caltrans operates in an increasingly complex regulatory environment. Starting with the passage of major environmental legislation in the early 1970s, the number of public agencies that review proposed projects has mushroomed. Caltrans is particularly affected by the environmental review process under both federal and state statutes because some of its projects are extensive and may affect wetlands, endangered species, and air quality.

A myriad of state and federal agencies need to review the environmental studies that Caltrans prepares. In addition to seeking approval on environmental documents, Caltrans must also receive permits from such federal and state agencies as the Corps of Engineers and Fish and Game and must sign agreements with local agencies. The permitting process runs sequentially to the environmental review process. Most recently, the federal Clean Air Act and similar state legislation have mandated that capacity-increasing projects in areas that do not currently meet clean air standards (nonattainment areas) must not worsen air quality. In effect, unless air pollution can be reduced in other ways, this aspect of the Clean Air Act will make approval for capacity-increasing projects in nonattainment areas very difficult for Caltrans to achieve.

Increased Public Awareness and Involvement

In the past, Caltrans could plan, design, and construct projects without much public input. Now, however, the public has become an important force that Caltrans must consider in order to obtain project approval. A number of factors have converged to increase public involvement in the planning and approval process for Caltrans projects:

- Public comment on projects encouraged by the environmental review process
- Growth in stature of special interest groups devoted to protecting the environment, such as the Sierra Club and Greenbelt Alliance
- Public reactions opposed to development of any sort, including transportation projects
- Support of local officials for local opposition to transportation projects.

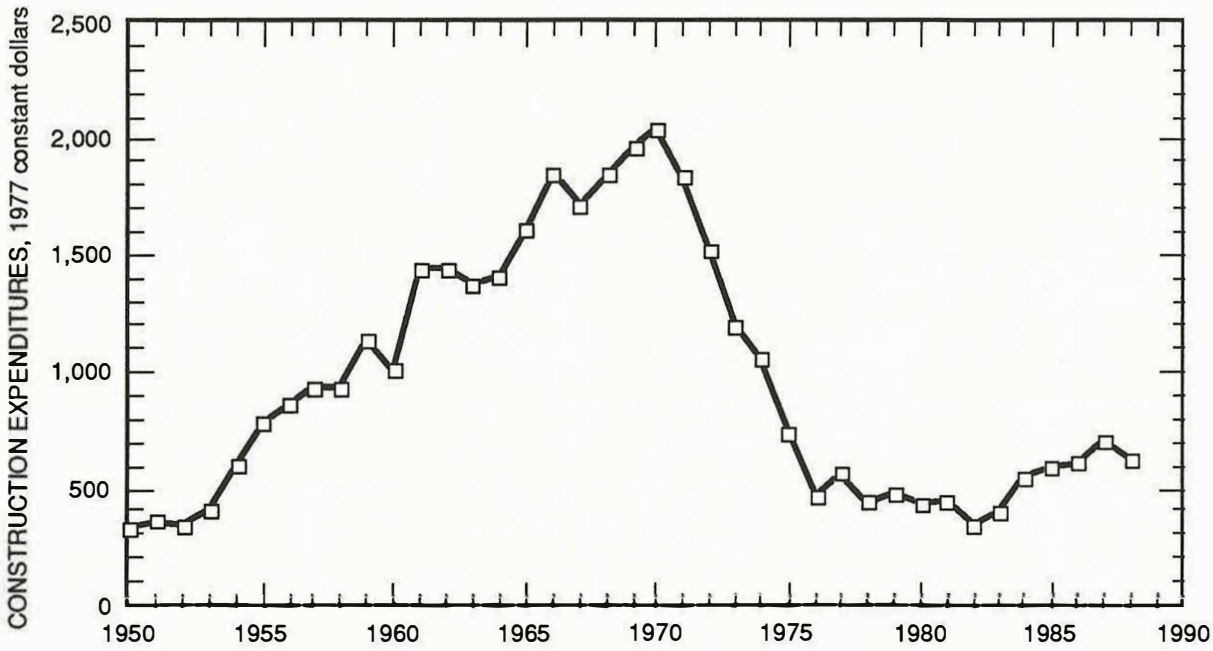
Through the use of lawsuits filed by local jurisdictions, citizen groups, and other special interest organizations, the judicial system is also involved in project review and approval.

FUNDING TRANSPORTATION IN CALIFORNIA

Following World War II, Los Angeles became known as "the freeway capitol of the world," and in 1953 the state committed the Division of Highways to build $1.3 billion worth of urban freeways in a multiyear program. In 1956, the federal Interstate Highway Program more than doubled highway investment in California, leading to a surge in freeway construction. This boom continued through the early 1970s (see Figure II-2).

Weak Financial Commitment to Transportation

Apart from the increases related to the *Blueprint* propositions, the state's fiscal commitment to transportation activities has been weak. Caltrans receives no monies from the General Fund; although this practice is common nationwide, it is unlike a handful of states in which General Fund monies *are* used to support transportation activities (Pennsylvania, for example, where 8%



Source: Jones, D.W. Jr., "California's Freeway Era in Historical Perspective," Institute of Transportation Studies, University of California, Berkeley (1989).

FIGURE II-2 EXPENDITURES FOR STATE HIGHWAY CONSTRUCTION

of the Transportation Department's budget is funded from General Fund revenues). Caltrans' funding comes entirely from state fees and taxes designated for transportation purposes, federal funds, and reimbursements. Even with *Blueprint*-related finances, California's gasoline taxes remain in the lower third nationwide.

Conversely, transportation program funds have been transferred out in recent years to accommodate the needs of other (nontransportation) funds and programs to help balance the budget. Recent examples include:

- $96 million loaned from the State Highway Account (SHA) and the Transportation Planning and Development Account (TP&D) to the General Fund for debt service on rail bonds
- $16 million of Seismic Safety Retrofit Fund (SSRA) interest to the General Fund
- $200 million in SHA interest and lease earnings transferred to the General Fund
- $4.8 million from the Aeronautics Account to the General Fund
- The TP&D "roundabout" in which $130 million of the TP&D transit capital trust fund was transferred to the SHA, in conjunction with an equal transfer to the Motor Vehicle Account (MVA) with an equal transfer to the Vehicle License Fee (VLF) Fund resulting in increased VLF subvention to local cities and counties of $130 million.

Although the outflow is relatively minor relative to the overall Caltrans budget, the net effect is an *outflow* of monies from transportation accounts, and not an *inflow* from other (nondedicated) state sources. Transportation accounts are viewed as an alternative funding source rather than an area of high-priority need. Were it not for the dedicated nature of the funding sources and the protection of Article XIX of the state constitution, we believe the outflow would be much greater.

Another basis for assessing California's commitment to transportation system development is to evaluate the growth of funding over time within the state and to compare funding levels with those of other states. As previously observed, the boom period of highway development in California (and nationwide) was between the late 1950s and mid-1970s. Since that time, highway funding has declined by any meaningful measure. As a share of the state budget, transportation expenditures (excluding Department of Motor Vehicle [DMV] and California Highway Patrol [CHP] expenses) have declined from 13% of the state budget in 1966 to a proposed 7% for the 1993/1994 fiscal year.

The recent increases resulting from Propositions 108, 111, and 116 have helped transportation expenditures to rise from approximately 5% in FY1985/1986 to the proposed 7% at present—again excluding DMV and CHP expenses. But even this growth of 2 percentage points lags overall growth.

A cross-state comparison (always difficult because of reporting differences) indicates that California spends more than any other state on transportation investments (see Tables II-1 and II-2). When figures are adjusted for population differences, however, California ranks 45th nationwide in combined state and local expenditures, even at the close-to-peak levels of investment in 1991. In comparisons of state-level expenditures only, California ranks last—50th.

Adequacy of Highway Transportation Investments

A recurring and unanswered question is whether the State of California is spending "enough" for transportation system expansion, rehabilitation, and maintenance. Direct answers are not available; no overall measure of performance of the state's transportation system (or of just the highway portion) exists. Indirect data, presented in Table II-3, suggest that capacity-expansion investments may not be adequate. The table identifies the growth in average daily trips (ADTs) at selected locations in the state highway system. As indicated, traffic volumes have expanded steadily, in several sample cases, tripling in the past 25 years. Yet during the portion of this time for which we have capacity data, the volume/capacity ratio deteriorated—capacity was growing at a slower rate than travel demand.

The impact of deteriorating levels of service has not been quantified. It is likely measurable in the emotional frustration and lost time of system users, elevated fuel consumption and cost, increased air pollution, and a perceived diminution in "quality of life."

The origins of the congestion problem are complex and embedded in our choices of residential and work locations, our recreational and shopping habits, and our lifestyles in general. It may be that attempting to support all these choices by a congestion-free transportation system is beyond the state's financial means (not to mention environmental capacity) and that solutions need to be more aggressively pursued in such areas as land use, telecommunications, and lifestyle changes.

Table II-1
STATE COMPARISONS OF TRANSPORTATION OUTLAYS

State	Resident Population	State Capital Outlay Total	State Capital Outlay Total per Population	Local Government Capital Outlay	Local Govern-ment Capital Outlay per Population	Sum State and Local Capital Outlay	State and Local Outlay per Population
Alabama	4,089,000	$ 379,893,000	$ 93	$44,224,000	$ 11	$ 424,117,000	$ 104
Alaska	570,000	192,891,000	338	63,400,000	111	256,291,000	450
Arizona	3,750,000	641,476,000	171	219,144,000	58	860,620,000	229
Arkansas	2,372,000	271,479,000	114	56,500,000	24	327,979,000	138
California	**30,380,000**	**2,018,668,000**	**66**	**1,365,717,000**	**45**	**3,384,385,000**	**111**
Colorado	3,377,000	393,443,000	117	188,634,000	56	582,077,000	172
Connecticut	3,291,000	848,133,000	258	65,900,000	20	914,033,000	278
Delaware	680,000	207,218,000	305	2,920,000	4	210,138,000	309
Distr. of Col.	598,000	122,078,000	204		0	122,078,000	204
Florida	13,277,000	1,161,149,000	87	597,706,000	45	1,758,855,000	132
Georgia	6,623,000	791,496,000	120	221,497,000	33	1,012,993,000	153
Hawaii	1,135,000	265,008,000	233	13,110,000	12	278,118,000	245
Idaho	1,039,000	122,509,000	118	18,373,000	18	140,882,000	136
Illinois	11,543,000	1,516,021,000	131	330,672,000	29	1,846,693,000	160
Indiana	5,610,000	642,812,000	115	90,527,000	16	733,339,000	131
Iowa	2,795,000	399,561,000	143	183,087,000	66	582,648,000	208
Kansas	2,495,000	364,785,000	146	43,694,000	18	408,479,000	164
Kentucky	3,713,000	494,776,000	133	65,005,000	18	559,781,000	151
Louisiana	4,252,000	622,768,000	146	140,726,000	33	763,494,000	180
Maine	1,235,000	165,065,000	134	20,165,000	16	185,230,000	150
Maryland	4,860,000	531,375,000	109	239,180,000	49	770,555,000	159
Massachusetts	5,996,000	632,523,000	105	101,249,000	17	733,772,000	122
Michigan	9,368,000	533,081,000	57	177,671,000	19	710,752,000	76
Minnesota	4,432,000	585,930,000	132	551,927,000	125	1,137,857,000	257
Mississippi	2,592,000	401,040,000	155	28,105,000	11	429,145,000	166
Missouri	5,158,000	373,487,000	72	157,477,000	31	530,964,000	103
Montana	808,000	176,139,000	218	43,960,000	54	220,099,000	272

Table II-1 (Concluded)

State	Resident Population	State Capital Outlay Total	State Capital Outlay Total per Population	Local Government Capital Outlay	Local Govern-ment Capital Outlay per Population	Sum State and Local Capital Outlay	State and Local Outlay per Population
Nebraska	1,593,000	$247,212,000	$155	$ 92,774,000	$58	$ 339,986,000	$213
Nevada	1,284,000	101,484,000	79	45,720,000	36	147,204,000	115
New Hampshire	1,105,000	76,062,000	69	29,450,000	27	105,512,000	95
New Jersey	7,760,000	575,286,000	74	40,247,000	5	615,533,000	79
New Mexico	1,548,000	243,252,000	157	17,200,000	11	260,452,000	168
New York	18,058,000	1,291,941,000	72	1,129,567,000	63	2,421,508,000	134
North Carolina	6,737,000	763,239,000	113	121,172,000	18	884,411,000	131
North Dakota	635,000	132,991,000	209	35,238,000	55	168,229,000	265
Ohio	10,939,000	1,007,149,000	92	313,524,000	29	1,320,673,000	121
Oklahoma	3,175,000	443,432,000	140	49,325,000	16	492,757,000	155
Oregon	2,922,000	355,983,000	122	144,495,000	49	500,478,000	171
Pennsylvania	11,961,000	1,315,605,000	110	165,775,000	14	1,481,380,000	124
Rhode Island	1,004,000	166,171,000	166	17,335,000	17	183,506,000	183
South Carolina	3,560,000	300,790,000	84	29,229,000	8	330,019,000	93
South Dakota	703,000	133,726,000	190	45,067,000	64	178,793,000	254
Tennessee	4,953,000	556,325,000	112	72,796,000	15	629,121,000	127
Texas	17,349,000	1,824,186,000	105	503,478,000	29	2,327,664,000	134
Utah	1,770,000	180,841,000	102	44,150,000	25	224,991,000	127
Vermont	567,000	87,837,000	155	22,760,000	40	110,597,000	195
Virginia	6,286,000	822,569,000	131	169,881,000	27	992,450,000	158
Washington	5,018,000	501,817,000	100	267,986,000	53	769,803,000	153
West Virginia	1,801,000	341,604,000	190	12,289,000	7	353,893,000	196
Wisconsin	4,955,000	557,282,000	112	251,625,000	51	808,907,000	163
Wyoming	460,000	219,205,000	477	18,803,000	41	238,008,000	517
U.S. Total	252,181,000	$27,100,793,000	$107	$8,670,456,000	$34	$35,771,249,000	$142

Source: *Highway Statistics, 1991*, Federal Highway Administration

Table II-2
RANKINGS OF TRANSPORTATION OUTLAYS BY STATE

State	State Capital Outlay Total	State Capital Outlay Total per Population	Local Government Capital Outlay per Population	Sum State and Local Capital Outlay	State and Local Outlay per Population
Alabama	28	41	46	30	46
Alaska	40	2	2	38	2
Arizona	13	11	6	13	10
Arkansas	34	31	29	35	32
California	**1**	**50**	**16**	**1**	**45**
Colorado	27	29	8	24	18
Connecticut	8	4	30	11	4
Delaware	39	3	50	42	3
District of Columbia	48	8	51	49	13
Florida	6	43	15	5	36
Georgia	10	27	20	9	29
Hawaii	35	5	43	36	9
Idaho	47	28	33	48	33
Illinois	3	24	25	4	24
Indiana	12	30	39	19	38
Iowa	26	19	3	23	12
Kansas	30	18	34	31	22
Kentucky	23	22	35	25	30
Louisiana	15	17	21	17	17
Maine	44	21	38	43	31
Maryland	21	36	14	15	25
Massachusetts	14	37	37	18	42
Michigan	20	51	31	20	51
Minnesota	16	23	1	8	7
Mississippi	25	16	45	29	21
Missouri	29	47	22	26	47

Table II-2 (Concluded)

State	State Capital Outlay Total	State Capital Outlay Total per Population	Local Government Capital Outlay per Population	Sum State and Local Capital Outlay	State and Local Outlay per Population
Montana	42	6	10	41	5
Nebraska	36	14	7	33	11
Nevada	49	45	19	47	44
New Hampshire	51	49	27	51	48
New Jersey	17	46	49	22	50
New Mexico	37	13	44	37	20
New York	5	48	5	2	35
North Carolina	11	32	32	12	37
North Dakota	46	7	9	46	6
Ohio	7	42	24	7	43
Oklahoma	24	20	40	28	27
Oregon	31	26	13	27	19
Pennsylvania	4	35	42	6	41
Rhode Island	43	12	36	44	16
South Carolina	33	44	47	34	49
South Dakota	45	9	4	45	8
Tennessee	19	34	41	21	40
Texas	2	38	23	3	34
Utah	41	39	28	40	39
Vermont	50	15	18	50	15
Virginia	9	25	26	10	26
Washington	22	40	11	16	28
West Virginia	32	10	48	32	14
Wisconsin	18	33	12	14	23
Wyoming	38	1	17	39	1

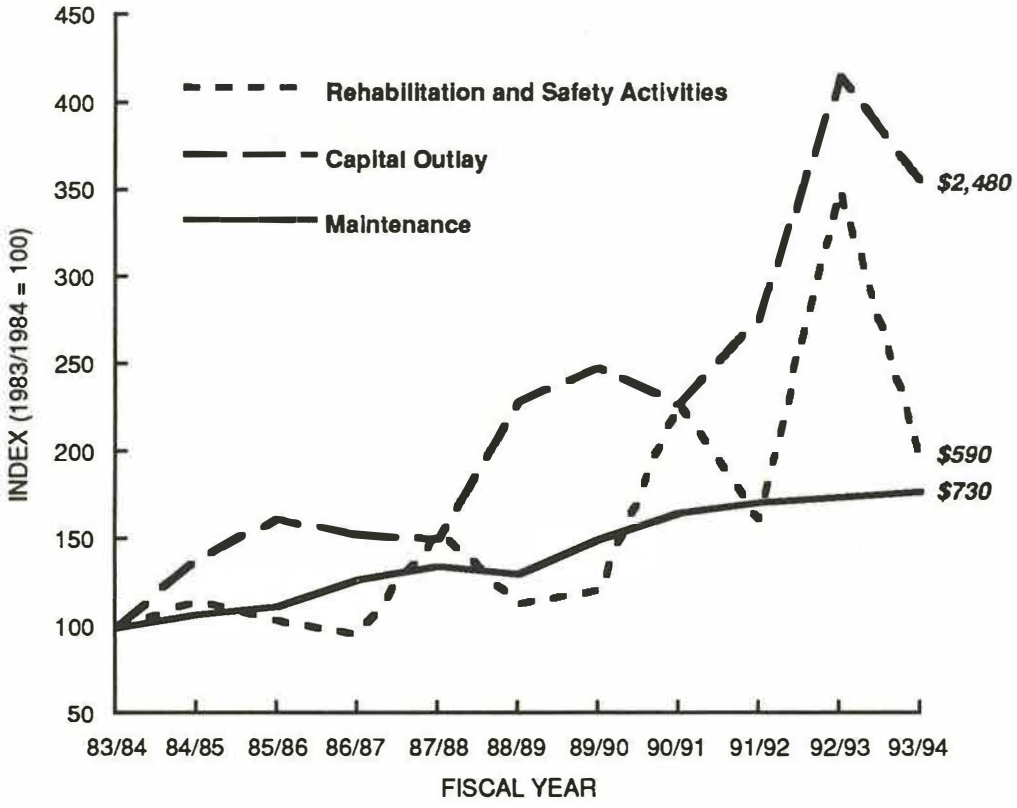
Source: SRI International

Table II-3
GROWTH IN AVERAGE DAILY TRIPS

State Highway by Location	Average Daily Trips				Peak Hour Demand as % of Capacity	
	1966	1976	1986	1991	1966	1986
ORG. Rt. 5 Santa Ana Frwy.–6 lanes S. of 17th St.	80,000	153,000	207,000	227,000	67%	142%
L.A. Rt. 405 San Diego Frwy.–8 lanes W. of Normandie Ave.	142,000	167,000	237,000	277,000	89	140
L.A. Rt. 101 Hollywood Frwy.–8 lanes S. of Vermont Ave.	163,000	178,000	243,000	252,000	102	145
L.A. Rt. 5 Golden State Frwy.–8 lanes S. of Victory Ave.	97,000	100,000	124,000	167,000	61	76
L.A. Rt. 605 San Gabriel Frwy.–8 lanes S. of Whittier Blvd.	76,000	127,000	135,000	196,000	48	98
SBD Rt. 215 6 lanes at Inland Center Rd.	53,000	81,000	115,000	157,000	44	10
S.D. Rt. 94 8 lanes at 30th St.	59,000	75,000	107,000	111,000	37	74
SCL Rt. 101 Bayshore Frwy.–8 lanes N. of Lawrence Expwy.	64,000	88,000	160,000	180,000	53	116
S.F. Rt. 101 Doyle Dr.–6-8 lanes S. end Golden Gate Br.	75,000	97,000	119,000	180,000	63	98
CC Rt. 80 Eastshore Frwy.–6 lanes S. of Carlson Blvd.	80,000	114,000	149,000	152,000	67	114
SAC Rt. 51 Business 80 Frwy.–6 lanes N. of Marconi Ave.	66,000	75,000	95,000	140,000	55	89

Source: CTC

The question still remains as to whether spending is sufficient and focused correctly. One perspective on the question is provided in Figure II-3, which tracks the growth of programmed funding for capital outlay (capacity expansion), rehabilitation, and maintenance over the last 10 years (indexed with FY1983/1984 = 100). The FY1993/1994 budget amounts are indicated in the boxes at the right. As shown, total capital outlay (all modes—$2,480 million) and maintenance ($730 million) are the larger activities.



Note: Numbers in italics indicate 1993/1994 actual

Source: Caltrans; SRI International

FIGURE II-3 COMPARISON OF PROGRAM ACTIVITIES

Capital Outlay. As indicated in Figure II-3, capital outlay expenditures have risen faster than all expenditure categories since the early 1980s; the increase has accelerated since the 1990 approval of the *Blueprint* legislation. The highway program budget for FY1993/1994 identifies a capital expenditure program totaling $2,317 million. Capital outlays are categorized in a variety of specific programs, five from the State Transportation Improvement Program (STIP), including:

- Traffic Systems Management
- Flexible Congestion Relief (STIP)
- Interregional Roads (STIP)

- Soundwalls (STIP)
- Maintenance and Rehabilitation
- Urban/Commuter Rail (STIP)
- Intercity Rail (STIP).

Caltrans and 41 regional agencies can nominate Flexible Congestion Relief (FCR) projects; Caltrans nominates Interregional Road and Retrofit Soundwall projects. The total amount nominated typically exceeds the estimated funding available. (At the time of this writing, the estimated shortfall for the 1994 STIP is approximately $2 billion.) As a result, despite the growth indicated in Figure II-1, funding shortages continue to hamper the expansion of the state's highway system, whereas other constraints imposed by categorical and programming minimums (e.g., the south/north split) constrain the ability to program projects with recognized needs without regard to location.

Highway Maintenance Program. The maintenance program budget for FY 1993/1994 is $730 million. Maintenance has a further significant effect on staffing, as it uses approximately 6,300 person-years (PYs)—about one-third of the total Caltrans workforce.

The importance of maintenance and the desire to make it efficient result from its leverage throughout the Caltrans budget. Maintenance of the state highway system, along with operation and rehabilitation, is the highest statutory priority of expenditure of SHA funds. As such, maintenance comes "off-the-top" of expenditures before capital outlay allocations; any inefficiencies in the use of maintenance monies reduces the amount available for other programs. This effect on capital and other programs is exacerbated by the formula-driven nature of the maintenance budget—maintenance costs increase with wage and benefit inflation (expected to be 4% to 5% annually) and with increasing lane miles and traffic levels (another 1% increase). In a slow- or no-growth funding environment, maintenance growth curtails other expenditures.

Maintenance is also unique among major highway expenditures in that it is almost entirely funded by state monies ($722 million from the SHA and $8 million of toll bridge funds). By comparison, capital outlay support is approximately two-thirds state/one-third federally funded, and capital outlay itself is about two-thirds federal and one-third state.

Caltrans undertakes a pavement survey every 2 years as part of its pavement management program. Although the numbers are difficult to aggregate on a statewide basis, Maintenance Division management reports that the rideability of roads has not deteriorated since the surveys were started in 1978. Division management does believe, however, it is not doing quite as well with structural problems. Nevertheless, it reports that many of these problems might be addressed by accelerating the repavement schedule to help extend overall highway life. If so, rideability can be maintained within the current budget (although some funding would now come from capital accounts, as more than routine maintenance would be required). (A greater problem is maintaining appurtenances such as pipes and fences and especially roadside rest areas to accommodate a sharp increase in their use.)

Rehabilitation. As illustrated in Figure II-3, annual expenditures for rehabilitation have fluctuated widely from year to year but overall have experienced average growth for the three categories displayed. The State Highway Operation and Protection Plan (SHOPP) defines the highway rehabilitation budget; for FY1993/1994, the amount budgeted for rehabilitation and

safety items is $590 million. For the 4-year SHOPP (1992 to 1996), pavement rehabilitation, bridge replacement and rehabilitation, and highway safety account for 51%, 17%, and 10% of the total expected costs respectively. Other items covered by the SHOPP include landscaping rehabilitation, emergency damage repair, land and buildings rehabilitation, and erosion control.

The SHOPP budget and set of projects are largely driven by need (i.e., the deterioration of the current highway system). A major problem would occur if resources were not being programmed and expended for these projects as required; however, that does not appear to be the case—at least for now. In the future, as the highway system continues to age, the rehabilitation portion of the budget will likely need to rise relative to the other categories discussed.

Balance. Not unique among states, the transportation development process in California can be characterized as revenue-driven (in contrast to need-driven). Maintenance and rehabilitation are driven by program (in some cases, statutory) requirements, whereas the size of the capital program is driven by fund availability. The life cycle needs of the highway system as a whole appear to be only minimally balanced, although the relationship between maintenance expenses and "inventory" and use is an appropriate type of conceptual linkage. We anticipate that the maintenance and rehabilitation needs will grow as the highway system ages.

Expansion of Transit-Related Funding

Caltrans' divisions of Mass Transportation and Rail promote the development of integrated, multimodal (nonprivate-owned-vehicles, nonair) services to improve the balance of the state's transportation system. To fulfill this policy, the divisions work in partnership with federal, state, regional, and local public agencies, as well as private entities, to perform the planning necessary to ensure that transit and rail options are included in transportation decisions and to facilitate the inclusion of transit in local land use decisions.

Funding for transit and rail has grown dramatically in recent years with the enactment of the *Blueprint* legislation, Proposition 116, and the increased flexibility afforded by ISTEA legislation. Compared with the less than $200 million average per year budgeted for rail and transit during the 1980s, for example, current programming calls for:

- $3 billion for intercity, commuter, and urban rail projects from Proposition 108, Proposition 156 (despite its defeat), and the 1994 rail bond measure
- $1.8 billion for rail and $30 million for ferry projects from Proposition 116
- A share of the approximately $2.7 billion FCR monies in the 1994 STIP
- Approximately $100 million in the TP&D account available for programming in 1994, with major recipients including the State Transportation Assistance (STA) program and Rail Services and Feeder Bus Operations (which includes state operational support for Amtrak intercity rail costs).

Figure II-4 illustrates the expected impact of this rise in transit funding on District 11 (San Diego) capital outlays. As indicated, from a very low level prior to 1990, transit-related investments have expanded to the point that they are likely to benefit from half the capital expended during the remainder of this decade. This situation is not unique to San Diego. Los Angeles and San Francisco counties are similarly using the majority of their county capital funds programmed in the 1994 STIP for transit-related investments.

Although this boom in transit and rail-related funding is occurring statewide, the role of Caltrans in support of these efforts remains less clearly defined than its highway-related responsibilities. Any estimation of appropriate staff size and/or efficiency in the rail and transit area requires a clear statement of Caltrans' responsibilities. Its present responsibilities are generally defined, but the rapid funding changes of the past several years requires that these responsibilities be clarified and reexamined in participation with regional planning agencies and other affected parties.

Increasing Importance of Local Measure and Federal Funding

The importance of the various sources of capitol funding is changing. As discussed, the funding directly available to Caltrans through transportation-dedicated capital taxes and licensing fees is forecast to increase in real dollar terms at a slower rate than construction cost increases. Federal sources anticipate level or increased funding through ISTEA. Local districts, which gained a funding source that does register real dollar increases (sales tax funding) now possess the revenue to undertake significant transportation activities but lack Caltrans' skills and resources to design, supervise, construct, or maintain improvements. Figure II-4 indicates changes anticipated in District 11's sources of capital outlay monies. Note that nearly all the incremental increases in spending projected for the 1993 to 1999 period derive either from local government or federal sources.

State Transportation Improvement Program

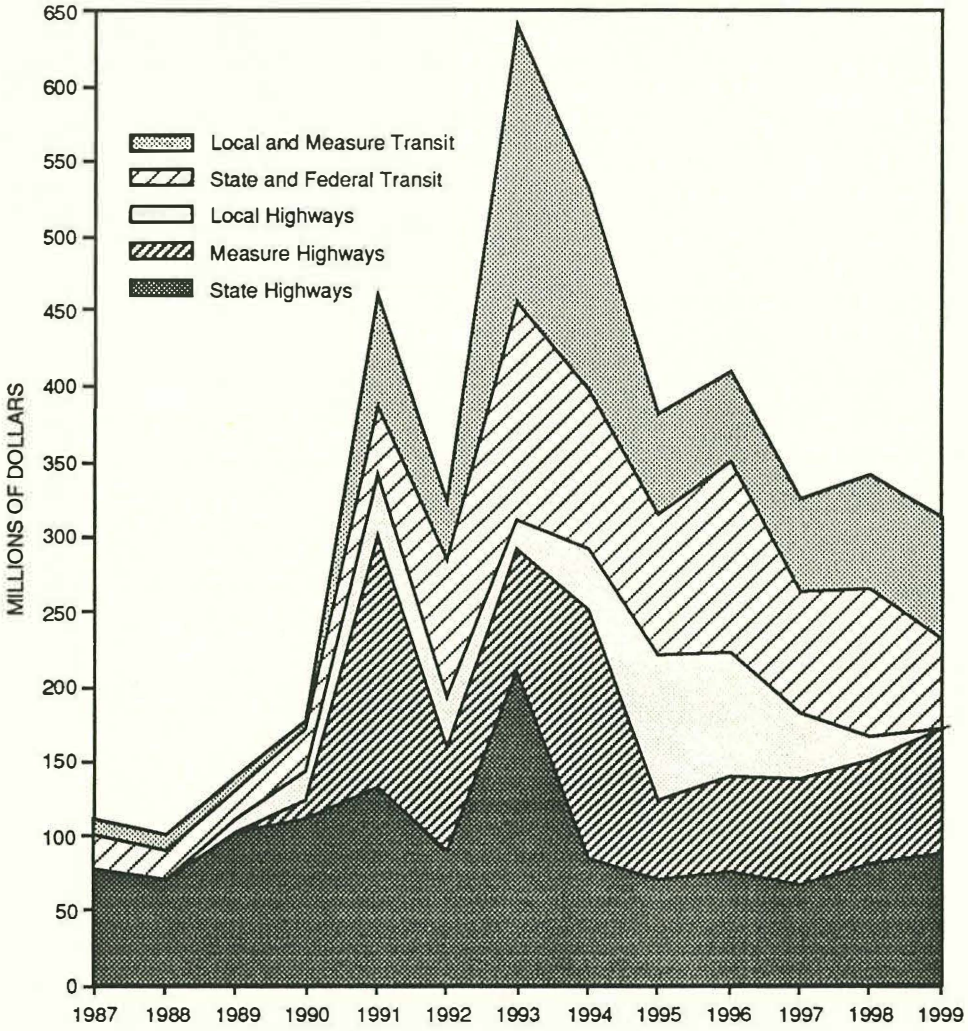
The STIP is a multimodal program of projects scheduled for funding from the SHA and the Passenger Rail Bond Fund for a 7-year period. STIP projects require capital outlays—they represent expansions of systems capacity. The STIP is formally adopted by the CTC.

The STIP is at the core of Caltrans' activity as the largest of the programs it delivers. It establishes the department's project schedule and from it is derived required levels of capital outlay support (professional person-years). Caltrans' (in)ability to deliver the STIP as scheduled is to many persons the primary measure of its performance and a major source of friction between the department and key partners and stakeholders.

Interviewees commented on virtually every aspect of STIP development and delivery. Numerous opinions and arguments exist both for and against current practice. In the following paragraphs we summarize two main themes:

- STIP fund estimating
- The STIP as a delivery schedule.

STIP Fund Estimating. As mandated by the legislature, Caltrans prepares a STIP fund estimate for CTC review and adoption. In preparing the estimate, Caltrans uses trends and existing law and follows a CTC-adopted methodology. The fund estimate is required to identify funds available for programming by county—incorporating legislative-driven county minimum formulas and considering the current and previous 5-year (quinquennium) county funding levels—and to identify progress toward meeting 10-year funding targets for individual programs. It takes into account funding needed for prior commitments and "off-the-top" noncapital activities (such as maintenance, administration, and operations) and then determines how much (if any) remains available for new programming.



Source: District 11 (San Diego), Caltrans

FIGURE II-4 DISTRICT 11 CAPITAL OUTLAY FORECAST

Yet even the best of methodologies requires significant assumptions; should any of these assumptions not be realized at some future date, STIP programming levels need to be revised. STIP cycles have arisen in which shortfalls in anticipated revenues have resulted in no new project additions (as occurred in the mid-1980s and the 1994 STIP). The effect is that peaks and valleys develop in the program, making it difficult to smoothly deliver projects as initially programmed in what becomes a "saw-tooth" delivery stream; this problem, in turn, leads to project delays, frustrated local expectations, and "ratcheting-down" of the program's size.

A question that arises, then, is how accurate STIP forecasts have been historically. To answer this question, we reviewed the evolution of STIP forecasts for three recent target years (fiscal 1991/1992, 1992/1993 and 1993/1994). The results are shown in Table II-4. Anticipated state funds (relative to what actually became available) have been overforecast in recent years by as much as 28% and underforecast by 7%. Estimating of federal fund availability shows greater variation, with a tendency to underforecast (although the FY1992/1993 "actual" used does not include a redistribution that occurred in August 1993).

Table II-4
VARIATIONS ON STIP FORECASTS (AMOUNT AND PERCENT OF ACTUAL)
($ MILLIONS)

Fund Estimate	FY1991/1992		FY1992/1993		FY1993/1994	
1988 Estimate						
State Resources	$1,181	(95%)	$1,213	(121%)		
Federal Resources	1,014	(73%)	1,043	(85%)		
Total	$2,195	(84%)	$2,256	(91%)		
1990 Estimate						
State Resources	$1,242	(108%)	$1,283	(128%)	$1,328	(128%)
Federal Resources	1,039	(75%)	1,031	(84%)	1,019	(59%)
Total	$2,281	(87%)	$2,314	(104%)	$2,347	(85%)
1992 Estimate						
State Resources	$1,160	(93%)	$1,201	(120%)	$1,236	(119%)
Federal Resources	1,471	(106%)	1,243	(101%)	1,227	(71%)
Total	$2,677	(100%)	$2,444	(109%)	$2,463	(87%)
1992 Revised Estimate						
State Resources	$1,221	(98%)	$1,164	(116%)	$1,167	(112%)
Federal Resources	1,465	(106%)	1,653	(134%)	1,639	(96%)
Total	$2,686	(102%)	$2,817	(126%)	2,826	(102%)
Actual						
State Resources	$1,242		$1,001	(p)	$1,038	(f)
Federal Resources	1,385		1,231	(p*)	1,732	(f)
Total	$2,627		$2,232	(p*)	$2,770	(f)

* = Data for 1992/1993 do not include a redistribution that occurred in August 1993.
p = Preliminary
f = Forecast

Sources: Caltrans, SRI International

The combined forecast shows less volatility than the individual state and federal resources estimates, but it still reflects fluctuations of about $500 million between forecast and actual figures. Numerous reasons exist to explain these changes—indeed, it would be more surprising if *no* variations occurred during the 6-year span. At the state level, for example, 1988 and 1990 estimates failed to anticipate the recession (with its direct adverse impact on fuel sales) and resultant state budget problems (and revenue transfers out of transportation accounts). Estimates in 1988 also predate the *Blueprint* legislation. At the federal level, authorizations are established when a measure is enacted, although year-to-year obligations often vary from these authorizations. Periodic reauthorizations (or the enactment of new legislation) can change the statutory funding limits from which STIP estimates are developed.

The many reasons for these variations notwithstanding, the periodic shortfalls generate delays and frustrations leading to criticism of program management effectiveness.

transportation issues. Nonetheless, as shown in Table II-5, the Caltrans budget (state dollars, and not including the DMV, CHP, and the Office of Traffic Safety [OTS]) is 57% of the estimated FY1992/1993 total budget for agency departments. (Caltrans' share is 69% of the estimated total department budgets in the agency if federal and bond funds are included.) Caltrans, DMV, and CHP combined comprise 96% of all agency department budgets, although agency staffing does not reflect the needs of Caltrans in the BT&H agency's overall portfolio of departments.

Table II-5
BUSINESS, TRANSPORTATION AND HOUSING AGENCY (BT&H)

Department	Budget* ($ millions)	Employees*	Summary
Department of Transportation	$5,400	19,400	Constructs, operates, and maintains state highway systems and provides other services
California Highway Patrol	680	9,040	Ensures safe, convenient, and efficient transportation across the state's highway system
Department of Motor Vehicles	520	8,600	Protects public interest in vehicle ownership, regulates issuance of drivers' licenses, and licenses/regulates businesses related to vehicle manufacture and sales
Department of Housing and Community Development	127	710	Expands housing opportunities through administering low income-oriented programs: analyzes/ implements/enforces building codes and standards
Stephen P. Teale Data Center	78	400	Assists state agencies through the application of cost-effective information technology
Department of Corporations	28	430	Regulates the offer and sale of securities, licenses and regulates investment brokers and agents, and regulates security advertising
Department of Alcoholic Beverages Control	23	370	Licenses and regulates functions related to the manufacture, sale, and purchase of alcoholic beverages within the state
State Banking Department	15	200	Licenses and regulates state-chartered banks and trust companies, issuers of payment instruments, and business and industrial development corporations
Department of Savings and Loan	$0.700	3	Protects public's savings and investment funds held by state associations

*1993/1994

Relationship with DMV and CHP. Organizationally, Caltrans shares several features with the DMV and the CHP. In addition to being part of the same agency, Caltrans is reviewed by the same senate and assembly committees and is funded from the same family of dedicated transportation accounts (MVA). Caltrans and the CHP have very complementary roles in the construction and operation of the state highway system.

Caltrans and the DMV have not historically had much interaction. The relationship is likely to expand, however, as new forms of "smart" automated toll collection and highway-use-related charges are evaluated and developed. DMV has long-established billing, accounting, and record keeping procedures that would simplify implementation of billing systems in support of such new technologies.

Caltrans and the CHP have a number of areas of joint activity, including traffic operation centers, truck-scale facilities (Caltrans builds, CHP staffs and maintains), Freeway Service Patrols (Caltrans funds, CHP supports), and, of course, the state highway (and soon toll road) system wherein Caltrans designs and CHP maintains safety. For the most part, relations proceed smoothly between the two departments. While these areas of joint activity are relatively minor in Caltrans' overall work schedule, they are more important in the CHP schedule. Thus, minor lapses in coordination by Caltrans' staff when they do occur can produce disproportionate problems for CHP management. It would therefore be helpful if Caltrans personnel could regularly include CHP management in planning activities for selected types of projects. Some districts do this as a matter of course; others seem to overlook the utility of CHP involvement in planning—particularly for enforcement-intensive projects such as high occupancy vehicle (HOV) lanes and metered on-ramps.

As congestion management grows in importance, Caltrans-CHP mutual efforts to improve traffic operations will also need to expand. As the state moves toward Intelligent Vehicle Highway Systems (IVHS) and increased applications of communications technology, the traditional roles between Caltrans and CHP for congestion management may blur.

Relations with Other Agency Departments. Beyond the interaction with CHP, Caltrans' main interdepartmental activities within BT&H occur with the Stephen P. Teale Data Center. The Caltrans Division of Information Systems (DIS) is a heavy user of processing services from the Teale Data Center. Beyond this, regular interactions appear to be few. At this time, the agency would like to establish closer linkages between Caltrans and the Department of Housing and Community Development to address large-scale development projects in a comprehensive manner.

Options

P1.1: Staff BT&H with Transportation-Oriented Deputy(ies)

In this option, BT&H would create and staff additional deputy or assistant secretary positions to address transportation-related issues. This addition would establish in the executive branch individuals who recognize the importance of policy, are knowledgeable about transportation issues, can link broader state needs with the capabilities and talents of Caltrans, and can therefore identify transportation policy issues that should receive gubernatorial attention.

The primary advantage of this option is that it would strengthen the linkage between Caltrans and the governor's office such that transportation issues would have an advocate (at the assistant or deputy secretary level). Conversely, policy decisions could be conveyed to Caltrans and the means for implementation sought through informed assessment of Caltrans' abilities.

The primary disadvantage of this option is that its success could depend entirely on the capabilities and skills of the individual(s) appointed to fill the position(s). BT&H has tended to focus staff attention on nontransportation issues over the past 5 years; despite the creation of position(s) to correct this imbalance, transportation issues may not receive significantly more attention at the secretary level than it has received in recent years. If the priority of interest does not exist at the secretary level, the role of the deputy or assistant could be quickly trivialized.

P1.2: Create a Transportation-Oriented Agency

In this option, a transportation-oriented agency would be created from several parts of the current BT&H agency. Because of the commonality of their funding sources, these parts would include Caltrans, the DMV, the CHP, and the OTS. Such an agency could either be created by moving the transportation-related parts of BT&H into a new agency, or by moving the nontransportation parts of BT&H into other existing agencies.

Several BT&H departments, for example, are strongly consumer-, licensing-, and/or regulatory-oriented (e.g., the Department of Alcoholic Beverage Control, Department of State Banking, and Department of Real Estate). These could be moved to the State and Consumer Services Agency. Corporations could be moved to the newly established Trade and Commerce Agency or to State and Consumer Services, depending on the goals for Trade and Commerce. State and Consumer Services already has several housing-oriented elements (Building Standards Commission and Office of Fire Marshall), and synergies between these and the Department of Housing and Community Development could be considered (although they are not strong).

The primary advantage of this option is that transportation-related departments (which comprise more than 95% of the budget for all departments in the agency) would have a cabinet-level position to act as a channel for direction of policy downward, and to facilitate problem identification and solution-seeking upward. A specific advantage would be the opportunity to restructure some transportation functions (such as Planning and Rail and Transit) and move them up as direct reports to the agency. It may also be possible to separate maintenance, design, and construction, and to have districts report at the agency level. These activities would be raised to a more policy-sensitive level. For planning, in particular, this shifting of emphasis from being part of primarily highway-oriented Caltrans to part of the agency would establish for it a broader perspective on the possibilities for transportation in California.

Another advantage of this approach, over that of establishing a dedicated deputy or assistant secretary, is that the sustained commitment to addressing transportation-related issues is more firmly established. A cadre of deputies, assistants, and/or other agency staff will assure continuity of familiarity and knowledge of transportation problems and requirements to a greater extent than a single appointee (agency head or staff). This approach also reduces the lack of policy direction that has arisen during long gaps before new directors have been appointed. Appointments of agency secretaries typically occur very quickly in new administrations, and vacancies do not remain long.

The separate agency also allows the Caltrans director and the agency secretary to develop complementary roles—not inappropriate for a $5 billion to $6 billion department. The Caltrans director can become primarily responsible for the efficient and effective functioning of the department; the agency secretary can lead in the political arena where funding and priority-setting issues dominate. Despite the efforts of some very capable directors of Caltrans in the past decade, we do not see evidence that any have been able to be fully effective in both realms.

The option has several disadvantages; the first depends on the procedure used to establish the Transportation Agency. If a new agency is created, supplementing those that already exist, then the cost of state government will be increased and the governor's number of direct reports (which already appears large) will be further increased. Reassigning departments to agencies along the lines we suggest would minimize this disadvantage.

The other disadvantage to this option is the possible conflict it creates in the executive branch between its own agency findings and reports, and those from the CTC, which is already mandated to report findings on transportation issues and problems to the governor and the legislature. Agency staff and CTC would not always agree; while a certain amount of debate on alternatives is appropriate, avoiding a paralysis of decision making due to conflicting advice and lobbying efforts is desirable. A means for effectively using CTC's experience and objectivity in support of the Transportation Agency decision making needs to be developed.

As noted, creation of a Transportation Agency allows for the possible division of Caltrans into functional departments (e.g., maintenance, design, and construction) reporting to the agency secretary, as well as the establishment of agency-level reporting for the districts. At present, we view the disadvantages of this approach (creation of too many competing functions) as offsetting policy-related advantages, except as regards the districts where an agency-level reporting point would enhance their autonomy and empowerment.

Recommendations

R1: Create a Focused Transportation Agency

SRI recommends that a more focused transportation agency be created. BT&H now has a wide scope of activities, ranging from the Department of State Banking and the Department of Alcoholic Beverage Control to Caltrans. Although transportation-related departments comprise more than 95% of the agency's budget, agency management tends to focus its attention on other areas. The recommendation to create an agency more focused on transportation is designed to increase executive branch attention to transportation, provide more emphasis on multimodal issues, enhance long-term direction, and enhance the executive branch's ability to respond to changing political and economic conditions that affect provision of transportation services to California residents.

Our specific recommendation is to move the nontransportation functions of BT&H (excluding the Teale Data Center) into other existing agencies and to rename the current agency. Although most of the nontransportation departments could logically be moved into other agencies (e.g., Trade and Commerce, State and Consumer Services), the Department of Housing and Community Development has no obvious alternate location. This function could remain in the agency because of its potential relationship with transportation issues. In this case the agency would presumably be titled the Transportation and Housing Agency.

Although no restructuring recommendation can guarantee that the executive branch will assign a higher priority to transportation, of all the options considered, this one has the strongest chance of providing the level of attention necessary to assure proper attention to this important area.

Finding P2: Lack of an Acceptable Statewide Transportation Plan

ISTEA legislation mandates the development of a state long-range transportation plan (the California Transportation Plan—CTP); requirements are further articulated in SB1435 enacted in 1992. The plan was due to Governor Wilson on December 1, 1993, and to the federal government on January 1, 1995. This plan must have three elements: policy, strategies, and recommendations.

Lacking the recommendations section of the CTP at this time, we cannot assess whether the plan provides a new perspective on the congestion problems facing California's urban freeways and the environmental problems arising from our automobile-oriented transportation system, how fully it seeks to exploit multimodal solutions to the state's transportation problems, how it addresses financing future alternatives, and how adequately it identifies a process to develop political consensus for solutions.

During the Brown/Gianturco period of the mid-1970s, a transportation plan was drafted providing a 20-year outlook for policies, projects, and programs. This plan became so politically controversial that it was not approved; further, the planning team was disbanded. Planning was severely curtailed at Caltrans until the early 1980s, although since that time department planning has resumed.

SB1435 (1992) mandates development of a state transportation plan to meet federal Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) requirements. Funding for the plan and its content (to include a policies element, a strategies element, and a recommendations element) are specified by statute. Interviewees anticipated, however, that the current CTP will be very general and provide little state leadership because this first step allows Caltrans minimum latitude to meet ISTEA requirements. The plan is expected to be a compilation of existing state and regional plans. Many fear that the current plan will be "overly general." If so, the state role in transportation planning will remain poorly articulated. The frustration is likely to continue that the state has no planning process that addresses modal balance, corridor requirements, and the need to balance system maintenance and expansion in a politically accepted manner.

Options

P2.1: Have CTC Review the California Transportation Plan

Because of the time and budget constraints under which the CTP was developed, we believe an independent critique is needed to determine whether it provides a solid basis for long-term transportation development in California. The CTC is in the best position to undertake this review. The advantages of CTC advice and comment are its independence from the planning process and its knowledge of local and statewide transportation issues and decision making. The disadvantage of CTC comment is that it remains advisory. Unless either the executive branch or

legislature requests that Caltrans address CTC recommendations, any advantages of its review are lost.

P2.2: Have CTC Advise the Legislature on an Ongoing, Statewide Transportation Planning Process

The transportation plan prepared under SB1435 is the first step in a multiyear process. If its benefit to the state's transportation community is to increase over time, it needs to be refined and redirected as lessons are learned from each annual iteration. Some form of feedback mechanism to the legislature is needed to help direct the process.

We believe the CTC could provide this annual feedback to the process because of its existing knowledge of issues and familiarity with local governments, ISTEA requirements, and key stakeholders. In this option, CTC would advise the legislature and agency secretary on the process to be undertaken in consultation with Caltrans (including budget estimates and major themes). An annual review of the planning process achievements would be included as part of CTC's annual report to the legislature.

The primary advantage of this option is that it establishes an ongoing, focused dialog on transportation issues for which solutions have heretofore proven elusive. Issues that could be included in the plan (of state benefit, to supplement those required by ISTEA) include Caltrans' role in mass transit and intercity rail, as well as the adequacy of capital, rehabilitation, and maintenance funding as a life cycle approach to highway requirements. A disadvantage would arise if the CTC/legislature interface was not effectively managed, as then any merit from the feedback would be lost and the entire effort reduced to a paper exercise.

Recommendations

R2: Amend CTC Responsibilities: Have CTC Advise on the Future Process and Budget for Developing the California Transportation Plan

The first CTP authorized by SB1435 was to be submitted to Governor Wilson in December 1993. Having this planning process reviewed and expanded to address a variety of transportation issues that affect California in general, and Caltrans in particular, would help clarify policies and direction in several transportation-related areas. Because the CTC monitors transportation issues around the state on an ongoing basis, we recommend that the commission review the planning process and advise the legislature on how the planning process (and the resultant annual CTP) can be strengthened to address more issues and problems. We anticipate that such advice would address questions of plan content, the process by which local input is sought, steps required for subsequent decision making, and an appropriate budget.

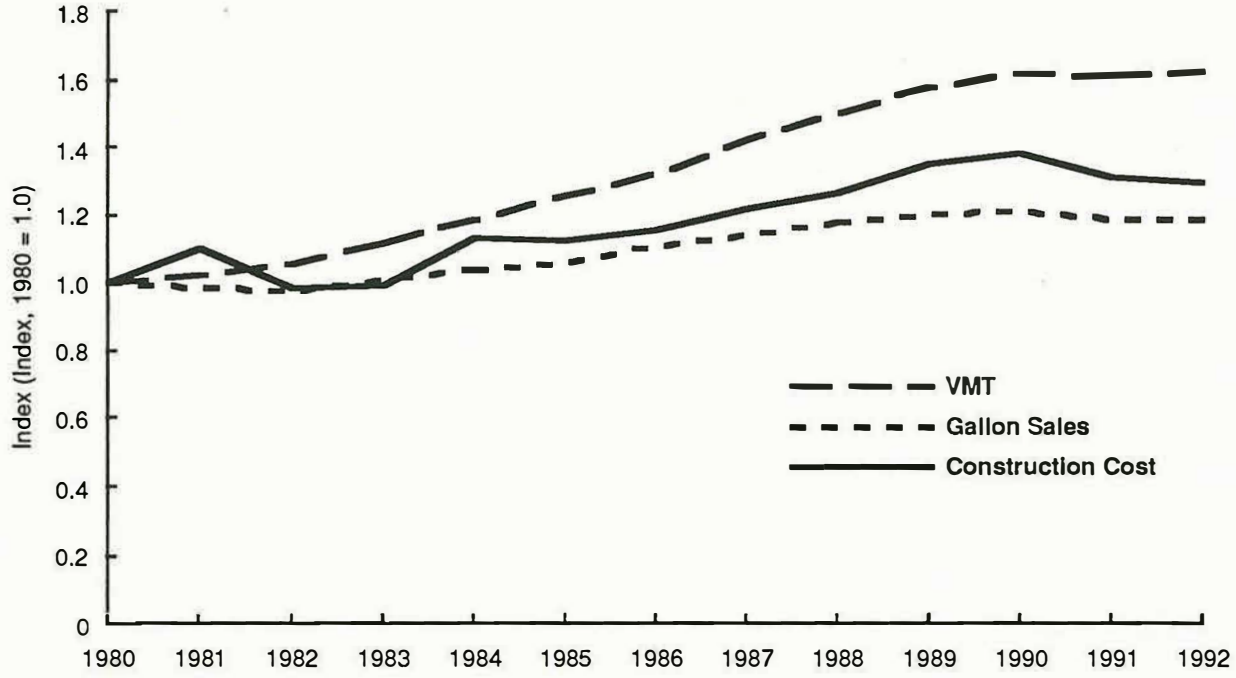
We further recommend that the legislature support the planning process as an ongoing opportunity to obtain local input toward the goal of developing consensus on key transportation issues. We envision this process to be issue-oriented and not to repeat the data collection and analysis of other plans except to the extent they reflect on the issues or themes raised in the year's agenda.

Finding P3: Declining Funding Based on Vehicle Fuel Taxes

Transportation funding based on motor vehicle fuel taxes will cause SHA purchasing power to decline annually. Historically, the growth in gasoline sales has occurred at lower annual rates than the growth in the construction cost index. This trend is likely to continue and may worsen as the state moves toward a growing fleet of zero- and low-emission vehicles in the latter part of this decade. As a result, tax receipts based on a fixed rate per gallon will decline in real purchasing power year by year.

Historically, the major source of state highway capital funding has been the SHA. Federal receipts from the Highway Trust Fund provide the largest single source of SHA revenue ($1.66 billion of a total $3.96 billion in FY1992/1993). State receipts are generated by excise taxes on motor vehicle fuels ($1.51 billion) and truck weight fees ($540 million). As a source of stable funding, fuel taxes are problematic without periodic readjustment; they can be expected to lag inflation for the remainder of the decade.

Our analysis indicates that the number of vehicle miles of travel (VMT) in California grew at an average annual rate of 4.1% between 1980 and 1992 (from 160 billion to 260 billion, approximately). During this same 12-year period, gasoline consumption grew by about 1.5% per year and Caltrans' Construction Cost Index grew by an annual rate of 2.2 %. The growth in these three measures is portrayed in Figure II-5 with all values indexed to their 1980 level.



Source: SRI International

FIGURE II-5 GROWTH OF VMT, GASOLINE CONSUMPTION, AND CONSTRUCTION COST

Despite the strong growth in vehicle travel, fuel sales and tax receipts (at a constant tax per gallon) grew more slowly because of increasing auto fuel efficiency. At a 1.5% per year growth rate, the constant dollar revenues available for transportation program funding fail to keep pace with annual increases in construction costs. Hence, each year the funding declines as measured by its real buying power.

We expect this lag to continue. If VMT continues to grow at 4% annually through the 1990s, and fleet fuel efficiency improves, but at a rate declining from 2.9% (achieved in the past 6 years with strengthened corporate average fuel efficiency [CAFE] standards for new cars and light trucks) to 1% (reflecting the decreasing improvements achievable as the in-service fleet approaches current new car standards), then total gasoline consumption will grow between approximately 1% and 3% annually. If inflation averages 3.5% annually during the remainder of the decade (as forecast by the State Department of Finance), then without a change in tax rate gasoline receipts will decline (in constant dollar terms) between 0.5% and 2.5% each year. Hence, fuel taxes need to be periodically adjusted to reflect the eroding effects of inflation.

To maintain transportation funding from these sources, the state needs to make corrective adjustments periodically. These can occur infrequently (and be large), or can be frequent (and small). The Transportation Summit and Blueprint Legislation of 1990 is an example of the former approach—it doubled motor vehicle fuel taxes (raising them by 9 cents per gallon over a phase-in period). This increase was only the second in 30 years. The problem addressed in this finding is that of maintaining funding of transportation improvements.

Inflation is not the only threat. If the state is successful in its goal to have 10% of new car sales be low- and nonpolluting vehicles by the year 2003, further erosion of fuel taxes can be expected. Pressure to achieve these emission-reduction goals will likely be maintained because of their positive effect on air quality.

If the traditional approach to transportation funding is maintained, years would elapse until transportation problems became sufficiently visible that a political consensus could be developed to (significantly) raise fuel taxes. The buying power of this funding would decline over time until the next significant need to raise funding arose. In constant dollar terms, a "boom-bust" approach would be taken to funding.

Options

P3.1: Tie Taxes to Indexing Mechanism

An alternative would be to index fuel taxes to construction or inflation-related cost increases so that tax increases would occur incrementally. The advantage of this approach is that funding is established in a way that maintains the funding level in constant dollars—the boom-bust cycle is avoided. The disadvantage is that it may create a perception that transportation funding is in some way keeping pace with demand, rather than merely remaining level in constant buying power. Whether the revenues raised through incremental tax increases fully meet demand would be determined through the STIP and other program reviews.

P3.2: Address Long-Term Funding Problem

To resolve the underlying problem of the adequacy of state transportation funding will require a complete reevaluation of the current basis for this funding. Indeed, dependence on

rising gasoline sales as the basis for funding programs is particularly unstable (not to mention paradoxical) in light of air quality, congestion-management, and other parallel efforts to reduce automobile travel.

Given the depth of passions raised by taxation discussions, and the state, local, and federal government's changing roles over the past few years, the process of addressing this problem needs to be examined carefully and designed to build a consensus over time. Any fundamental shift in funding formula will need to take years to develop and therefore must be linked to an ongoing process. The question could be addressed as one part of the California Transportation Plan preparation process because public and stakeholder involvement would be available as would data on expected needs and resources. A disadvantage of this option is that too widespread a discussion may politicize factions and stymie efforts to change because of the lack of consensus on any particular alternative.

Recommendations

Recommendation R2 also contributes to this solution.

R3: Extend the Statewide Transportation Planning Process: Evaluate Long-term Transportation Funding Requirements

The primary source of transportation funding is the fuel tax, based on gallons sold. As automobiles become more efficient in response to the market and federal CAFE standards, fuel tax revenues are declining in real dollars. At the same time, the cost of highway maintenance and construction is escalating faster than revenues. The result is that transportation revenues do not keep up with expenditures. If fuel tax revenues are to keep up, rates will need to be adjusted every few years. If not, expenditures will consistently decline in real terms. Local and regional sales tax measures have been adopted because the state is not expanding the capacity of transportation facilities at a high enough rate.

Because financing needs continue to grow faster than available resources, additional resources to maintain the program are needed. These may involve changes in current user fee structures, or the move to a different basis for supporting transportation investments. We recommend that the problem of how to best stabilize funding for transportation needs be addressed through the California Transportation Plan process.

Finding P4: Lack of Leadership Role for Caltrans in Mass Transportation Activities

Caltrans promotes the development and coordination of rural, small urban, and metropolitan transit services and works in partnership with national, state, regional, and local agencies (public and private) to perform transit planning. The department coordinates these activities internally to ensure that transit options are considered in transportation decisions. Unlike its role in the state highway system, however, Caltrans (with few exceptions) does not execute mass transportation-related projects. Project execution is the responsibility of the local agency or district, or of Amtrak. At present, statutory justification for further Caltrans involvement in mass transportation is lacking, as is local support for an increased role.

Many people are frustrated with the state's inability to develop a truly multimodal transportation system; the brunt of this frustration falls on Caltrans as the state's transportation department. Prior studies (e.g., Little Hoover Commission reports in 1988 and 1992; *Senate Advisory Commission on Cost Control in State Government*, 1990) and interviewees have consistently described a "highway bias" at Caltrans. Clearly, very little staff commitment (about 1% of personnel) and less than 1% of capital outlay (until *Blueprint* funding began to take effect) went to transit. Only in the past 2 years has the director appointed a deputy for rail and transit activities (with a staff of approximately 120 persons at headquarters supplemented by approximately 70 more in the districts). Interviewees noted that many of the additions appear to be highway-oriented engineers transferred to the new division.

Within Caltrans, line functions are overwhelmingly devoted to road engineering. Budgets and headcounts, however, reveal the extent to which the chief engineer and the roads he designs and builds express the ambitions of Caltrans.

A major part of the problem is that the state's role in transit activities has historically been (and remains) very different in character from its role as "owner and operator" of the state highway system—wherein it both builds and maintains the system. The state has a traditional involvement as the conduit for highway-related funds, which it either commits directly or passes through to local jurisdictions. Transit funding has flowed directly from the federal government to providers based on formula-driven and discretionary criteria; the state has had only a minimal role.

Because of *Blueprint* and ISTEA requirements, however, Caltrans' involvement in rail and transit activities is increasing. The desired or appropriate role is not defined nor did interviewees reach consensus on what it should be. Many want local governments and planning organizations to continue to maintain the lead in transit development. If this is the case, then Caltrans' efforts to develop a Transit Resource Center to provide technical support and training may be representative of what the state role can be.

Indeed, some interviewees did not trust Caltrans' involvement in rail planning. An example cited was Caltrans' participation in rail extension planning in the Ventura Freeway Corridor. In the debate between an elevated line in the freeway right-of-way versus a subway alternative on a different routing, Caltrans supported the elevated line. Because Caltrans would do the engineering for the freeway alignment, but not for the alternative, questions of bias have been raised.

An expanded state role is possible to supplement present support for the San Diegan- and San Joaquin-Capitol intrastate routes and to undertake both conventional and high-speed rail planning. Interestingly, though, no interviewee cited (either favorably or negatively) Caltrans' "Rail Passenger Development Plan" of July 1991. We believe that interest in this issue is not as well focused as with other issues encountered.

If the status quo were to be continued, we believe Caltrans would promote and coordinate mass transportation-related activities in a partnership role with implementing agencies. Staff size and capabilities, however, would continue to be loosely defined by the needs of this support role. Decision making regarding the future direction for statewide mass transportation development would continue to be driven by funding levels, established programs, and periodic, issue-oriented study efforts.

Options

P4.1: Seek Role for Caltrans Consistent with Local Leadership

Caltrans can undertake several actions to further facilitate mass transportation development without taking a lead position. Continuing to provide management information on transit and rail services through the Public Transportation Facilities and Equipment Management System (PTMS) and to enhance staff development through the Certificate Program in Transit and Rail are examples of the statewide supporting role toward which Caltrans is already moving. Further efforts of this sort might include centralizing procurement of equipment (such as occurred with the California Car) where a large order might lower costs to individual transit properties (large and small). Efforts to identify an appropriate and desired role could be conducted as a single-issue effort, or could be incorporated into a statewide transportation planning process.

The advantage of this approach is that transit operators statewide could become more efficient by sharing information, training, and procurement through the coordinating efforts of Caltrans. The disadvantages are that statewide mass transportation developments will continue to be program- and budget-driven, and development of a state plan for mass transportation will be delayed.

Recommendations

Recommendation R2 also contributes to this solution.

R4: Extend the Statewide Transportation Planning Process: Identify Caltrans' Mass Transit Role Consistent with Local Leadership

The planning and operation of local mass transit services should remain the responsibility of local or regional agencies; however, Caltrans can facilitate mass transportation development and efficiency without taking a lead position. Examples of mass transit activities Caltrans is already engaged in are provision of management information on transit and rail services through the PTMS and enhancing staff development through the Certificate Program in Transit and Rail. Caltrans also manages the program of federal transit grants to rural transit providers.

We suggest that further efforts of this sort include centralizing procurement of equipment where a large order would provide economies of scale for individual transit properties (such as was done with the California Car), evaluating equipment performance, and extending the amount of technical staff training made available to local properties. We recommend, in particular, that Caltrans' mass transit role be addressed as a component of the expanded California Transportation Plan preparation process (see Recommendation R2 above).

R5: Extend the Statewide Transportation Planning Process: Identify Caltrans' Intercity Rail Role

Unlike its role in intracity transit service, Caltrans has taken clear responsibility for promoting and sponsoring intercity rail service. Propositions 108 and 116 have both increased intercity rail service, furthering prior plans and efforts with services such as the San Diegan, San Joaquin, and Capitol Corridor services. Through provision of grants, Caltrans works with local

agencies on station planning and development. It appears appropriate that the trains are operated under contract, with Caltrans' role limited to management and subsidy funding.

In the short term, Caltrans can usefully continue its efforts to improve facilities, support efforts to operate trains at higher speeds, and evaluate opportunities for a mode choice that competes economically and effectively with automobiles and airlines for intercity travel. If Caltrans is to proceed beyond planning studies for high-speed rail development, however, a long-term commitment of potentially substantial state resources is required. The economic, environmental, and operational feasibility of high-speed service needs to be fully assessed. We recommend that the specifics of such an assessment be addressed through the California Transportation Plan planning process, with the assessment itself be undertaken as an effort separate from the CTP. The results, however, should be merged into CTP reviews.

ORGANIZATIONAL STRUCTURE

Finding O1: Duplicate Expertise and District Boundaries

Under current policies, each district performs essentially all work functions. The duplication of line functions, such as planning, supervision, and maintenance, appears to be more suitable than the duplication of such staff functions as laboratory work, personnel, payroll, and general accounting. Some of these functions appear suitable for regionalization; others could be accomplished online to Sacramento.

Duplication of district expertise is widespread; for example, each of the 11 original districts maintains a laboratory. Moreover, in some areas coordination between Sacramento and the districts requires duplication of local expertise at the headquarters level. Headquarters-based officers, however, have only a dotted line relationship with district-based officers in the same functional areas; therefore, sharing information and making trade-offs and agreements on positioning, protocol, and policy appear to occupy a disproportionately large percentage of time and attention, and requires the intervention of senior officials, including the director, to resolve disputes between headquarters and district organizations. A structure that moves functional responsibility to regional centers and leaves policies and guidelines to headquarters makes sense. Some joint or matrixed responsibilities are inevitable to maintain control and to achieve efficiencies, but regionalization of functions avoids the clumsiness of an overly matrixed structure.

Historically Driven District Boundaries. With the exception of District 12, created by legislative fiat in 1987, the district office structure of Caltrans has not changed since 1933. Documents and interviews expose decision criteria that appear to have been important in establishing district boundaries. Among the most important are the following:

- Roughly equal mileage in a contemplated state highway system
- A large town or city to serve as a headquarters location
- Political patronage anticipated to flow from Caltrans as a source of jobs
- Political benefits anticipated to flow from Caltrans spending.

Knowledgeable interviewees and analysts insist that political reasons have been more important than performance in the continuity of the district structure. They add that political criteria persist as the central reason for the inviolability of the existing districts, despite the massive changes in the population, transportation systems, and technologies over the 70 years since the district structure was established.

If we disregard political pressures, at least three regions—metropolitan north, metropolitan south, and the rest of the state—have reasons for existence in geography, population, and the need for integrated transportation solutions. Organizing regions to parallel those of regional or metropolitan planning organizations, or councils of government that address transportation-

related issues of air quality or congestion management, may bring benefits in out-of-pocket expenditures, as well as in the coordination of action and in the capability to respond to requests for service absent in the existing structures.

Positive Features of the District Structure. Our interviews indicate that Caltrans receives the highest compliments where the local district office was considered responsive and a partner in local transportation planning and implementation. To the extent the district office relations were positive, the image of Caltrans is likewise. Greater effort to empower districts would be entirely in line with the current private-sector management approach of pushing decision making to lower units closer to the customer. For Caltrans, the "customer" is frequently the local counties—where district-oriented relations are key. In the words of one regional respondent, "Highway construction is one-third technical, one-third financial, and one-third political. Caltrans only controls one-third of the resources." Caltrans' district offices are vital to connect execution capability with funding sources.

District offices have been the source of active experimentation over the years. The relative independence that district directors have enjoyed from headquarters has encouraged individual districts to undertake experiments in design, construction management, materials utilization, and a host of planning activities. Vital to experimentation in a number of districts were creative budgeting practices by the district directors (e.g., the experiment in District 2 with the Northern Design Group). We believe the opportunities for district experimentation are a harbinger for further changes along district lines.

Options

O1.1: Reallocate District Functions

Functions could be reallocated without changing the geographical extent of the existing districts or their headquarters locations, or the primary responsibilities of district directors. Examples of such activities include Human Resource functions, MIS support, and provision of environmental or technical specialists. In this view, one district would oversee a function—line or staff—across district boundaries, responding to cross-district issues in a metropolitan setting. For example, Los Angeles and San Diego could consolidate southern planning functions in order to improve coordination with the Southern California Association of Governments (SCAG) and the San Diego Association of Governments (SANDAG). Or a subdistrict territory—a city, unincorporated county land, or an entire county—could pass from one district to another temporarily or permanently. District 2, Redding, for example, could take over Glenn and Butte counties from District 3, Marysville.

The advantages of this option are, first, it is fully within Caltrans authority to implement and, second, it accentuates trends that are already beginning to change the nature of interdistrict relationships. The disadvantage of this option is that if not pursued to the fullest extent, it reduces the amount of savings that might be obtained from a more thorough change to the structure.

O1.2: Regionalize Structure

As an alternative, the existing district structure could be modified in favor of a regional structure. This structure might include a northern metropolitan region, encompassing the San

Francisco Bay Area, a southern metropolitan region, encompassing the Los Angeles Basin and the Los Angeles-San Diego corridor, and one or perhaps two rural districts.

The purpose of this structure would be to undertake work at the lowest feasible level at which it could be successfully accomplished. Activities and functions could be moved from state headquarters to regional headquarters, as well as could activities and functions from the districts (such as the human resource, MIS, and technical skills cited in the preceding option). The net effect sought is a reduction in staff through the elimination of district redundancies, rather than the creation of a new bureaucratic layer. Regional offices would likely be co-located with selected existing district offices.

The advantages of a regionalized structure are that, first, regions respond to the lifestyle and transportation realities and prospects that group more than 70% of the state's population in less than 30% of its geography. Second, regions reduce the complexity of management across MPO and RTPA boundaries, reduce the number of redundant staff and line positions, and offer the prospect of significant cost savings.

The main disadvantage of regionalization is that it could lead representatives of rural districts to claim that they have lost employment opportunities, associated sales tax revenues, real property tax revenues, and Caltrans' support.

O1.3: Modify District Boundaries

As a third alternative, consolidating smaller districts and redrawing boundaries for those that remain is a way to respond both to improvements in technology, which reduce the need for a physical presence, and the demographic concentrations of population within the state. For example, Districts 1 and 2 could be consolidated in Redding with a subdistrict office in Eureka. The functions of District 9, currently headquartered in Bishop, could be merged with District 8, San Bernardino, and District 3, Marysville, with a single district office supported by subdistrict offices.

The advantage of this option is that it aligns Caltrans resources and stakeholder problems. In addition, this option allows staff functions to be combined in some cases with consequent cost savings, and may permit more congruence between Caltrans district boundaries and those of MPOs and RTPAs. The disadvantages of this option are, first, tinkering almost inevitably sets off disputes among the putative winners and losers, threatening the principles that led to the proposed changes; second, larger districts may generate negative results because of their size, which, for example, works against close relationships with local agencies and local resolution of issues; and third, these remedies still do not reflect the opportunities in technology.

Recommendations

R6: Increase Caltrans' Efficiency by Regionalizing Functions

The most appropriate means to bring new technologies to bear on transportation solutions is to assemble an internal team to redesign the geographic distribution of Caltrans' functions—with first attention to staff functions. The operative principle of this redesign should be to create a new flow chart of activities and processes that optimize tasks and outcomes at the lowest cost-effective level through the use of information and communication technologies; outside

assistance should be sought if the opportunities that these technologies afford are not well understood internally. The net effect of this redesign is a consolidation of staff.

Use of appropriate hardware and software should permit a wide range of currently distributed staff activities to be centralized regionally. Moreover, an open charter to optimize functions should lead to a redistribution of responsibilities within the existing district system. Regionalized functions are logical alternatives to the existing, district-oriented distribution of functions. Identifying the exact number of regions and their exact boundaries for each function regionalized falls within the purview of Caltrans' managers whose performance will be determined by their ability to reduce overhead costs over time; however, the obvious minimum divisions are the metropolitan south, the metropolitan north, and the remainder of the state. Resolving the regionalization issue will dictate the functions of the remaining district offices.

Over time, regionalization efforts may provide sufficiently strong benefits that savings can be realized through a formal regionalization of Caltrans' structure (rather than just of functions as recommended). In such an event, investments in facilities and staff located in the current district headquarters sites make them the most likely locations for subregional units.

We recognize that any changes in the distribution of Caltrans employment can produce intense lobbying efforts by parties who believe themselves to be adversely affected. As a result, Caltrans needs to develop a procedure that will allow its managers (who are held accountable for the success of cost reduction efforts) to make the changes they deem appropriate. The legislature needs to concur with a nonpartisan approach—in advance—and be allowed to review the outcome only with a majority vote.

Caltrans management can develop the specifics of the implementation plan. One example would require that changes that Caltrans management or a special bipartisan commission advances in implementing this recommendation be reviewed with the governor's office and the CTC to ascertain that the modifications can reasonably be expected to lower costs. (The goal of the gubernatorial and CTC review is not to advance alternative changes, but simply to assure that the changes are not spurious and appear reasonably likely to reduce costs. This process may be repeated annually as incremental changes are introduced.) Once these two parties have concurred that the proposed changes reduce current costs of operation, a two-thirds vote of the legislature would be required to reverse the proposed changes.

OVERALL MANAGEMENT AND LEADERSHIP

Finding L1: Establishment of Mission, Policies, and Strategies

Each director has chosen to address the mission, policies, and strategies of Caltrans differently. Generating such statements is appropriate to the role of the director. The present statements are comprehensive, internally consistent, and allow for more specific implementation measures to be derived from them. As such, we have no basis for recommending changes thereto.

Each incoming Caltrans director has attempted to state his or her view of the department's priorities—usually within a few weeks or months of taking office. These statements vary widely in scope and detail. Some scarcely count as "mission statements" in the commonly accepted sense of stating "what business we are in." Others muster focused action plans, objectives, and goal statements (for example, *Caltrans' Strategic Management Plan*, March 1990; and *California Transportation Directions: Mobility for 2010*, January 1991, prepared by the California Transportation Directions Policy Committee under the cochairmanship of Bob Best and Mark Pisano). These statements typically give attention to multimodal concerns; many interviewees contend, however, that the unspoken context for most of these statements has been that Caltrans is primarily responsible for designing and building a highway system for California.

The current director appears to have devoted more resources to mission, vision, and strategy than most of his predecessors. A series of brochures, *Transportation Vision for California*, a video tape, and a series of staff meetings announced a vision, purpose, mission, values, and goals for Caltrans that differ from previous statements.

The key element of the mission and vision is an integrated, multimodal transportation system with widespread stakeholder (partner) involvement in development and implementation. Within this context, the Caltrans mission and vision cast a wide net. The vision and mission explicitly include the transportation of information and services, in addition to the mobility of people and goods. This latter inclusion provides a long-delayed recognition of the substitutability of communications for transport.

Another distinguishing feature of Mr. van Loben Sels' mission and vision statements are the way they are carried forward into more focused planning and budgeting documents. Examples are the *Discussion Guide for Caltrans Transportation Vision for California* (January 1993), the discussion draft of the policy and strategy elements of the *California Transportation Plan* (June 1993), and *Caltrans Budget Strategies 1993-1995* (April 1993).

Criticizing mission statements is seldom useful. These statements articulate the orientation of leaders—policy choices that typically cannot be identified as right or wrong, or good or bad. We tend to judge mission statements on the inclusiveness and realism they evidence, and we tend to use them as touchstones for judging the adequacy of implementation.

The *Transportation Vision for California* directly responds to many of the criticisms frequently voiced about the department. The text names safety, speed, and cost-effectiveness as

key goals. It positions transportation within demographic, economic, and environmental contexts. It acknowledges stakeholders: not simply Californians as informed choosers of transportation alternatives, but the heightened importance of local and regional transportation service providers; the department as an interregional planner and provider on a statewide basis in a federal system; employees; outside vendors; and the disadvantaged. As such, it appears appropriate to the state's needs as we have heard them articulated in our interviews and report reviews.

Some critics are apt to agree that responses to their objections mark advances over the neglect, the exclusive orientation to roads, and the overwhelming technical emphasis that characterized earlier mission and vision statements. Other critics will urge that the *Transportation Vision for California* announces a willingness to work within current structures, policies, and human resource constraints. Those who doubt the adequacy of the department, its policies, and the ability of its personnel to accomplish the announced goals will scarcely be satisfied by the meliorative tone and content of the mission/vision/goal statements, or the subsequent related drafts and documents generated under the aegis of the current director.

Options

No option is associated with this finding.

Recommendations

No recommendation is required by this finding.

Finding L2: Lack of Implementation Plan

Caltrans currently lacks an implementation plan describing how Director van Loben Sels proposes to accomplish the mission, values, policies, and strategy statements he has developed.

The issue here is timing. Director van Loben Sels had planned to generate an implementation plan by December 1993. Other issues have intervened, however, so that the schedule is now delayed. The new date for the plan is still to be determined.

The thoughtful improvements featured in the vision statement and the documents that flow from it include goals and subelements, but they have no direct counterpart in an implementation plan. Implementation steps may be part of the "Recommendations Element" of the California Transportation Plan, which was due to be submitted to the governor by December 1, 1993. Discussion drafts of this element were not made available to the SRI team in time for this evaluation.

Implementation planning is usually understood as a flow from generalities to specifics that encompasses reporting on activity ("feedback loops") to permit judgments about the extent and intensity of the achievement of goals. Industrial engineering practice, which is often a guide in discussions of this kind, typically ties the more specific and action-oriented elements from the flow to a schedule in order to create a time-phased flow diagram (a Gantt chart).

The mission, vision, values, and goals that Caltrans has developed are not the sorts of planning elements for which feedback loops are appropriate. The department is devising

objectives to implement strategies with appropriate feedback loops. Other claims on attention, of which litigation regarding contracting out is the most prominent, have recently diverted management from these steps.

Options

L2.1: Complete the Plan

We endorse the need for completion of the director's implementation plan in order to provide specific substance and direction to his previously established missions, values, and goals. This plan should incorporate specific performance measures that will enforce actions toward the goals it identifies.

Recommendations

R7: Develop an Integrated, Viable Implementation Plan for the Mission, Values, and Goals

Caltrans' existing mission, values, and goal statements set a tone and direction for future activity. They need to be supplemented with specific strategies to assure action directed toward these ends. In addition, a part of these strategies should identify measures for evaluating progress.

We recommend that Director van Loben Sels establish as a priority completing the development of strategies for implementing the goal statements. This recommendation links with others that address project delivery planning, staff planning, and performance measurement in that the metrics established in the implementation plan should be the same (or, at least, consistent with) those that are described in the following finding and recommendation.

Finding L3: Inadequate Performance Measures

> *The SRI study team sought to determine whether Caltrans had become more, or less, efficient over the last 10 years. Unfortunately, yet not unusual for government agencies, no consistent measure of output could be identified. Further, no set of overall department measures exist that disaggregate into division, functional unit, project, and individual staff targets to use as the basis for regularly tracking achieved performance versus target and for annual performance reviews. Such measures are essential if Caltrans is to improve its efficiency and productivity.*

Well-managed private and public sector organizations attempt to integrate information from both top to bottom and bottom to top, while also assuring that different functional activities and sources are included; that is, a measurement system integrates both vertically as well as horizontally across the organization. Further, an effective organization accomplishes these kinds of integration in a timely fashion. While the exact definition of "timely" varies with the function being measured and the measurement applied, measurements are generally considered timely when they can be diffused throughout the organization sufficiently quickly to permit corrective action on problems noted in the prior reporting cycle (e.g., weekly, monthly, quarterly). The operative rubric is that "you cannot manage what you cannot measure."

Throughout our evaluation, we discussed with interviewees and sought overall productivity measures with which we could review Caltrans' performance over time. Specific measures of project delivery performance and overhead expenses were observed, but none were identified that reflected the overall performance of the department (e.g., dollar value of projects delivered per employee, lane miles maintained to a certain overall standard for the resources expended on maintenance). Instead of finding ratios of outputs to inputs, we obtained lengthy explanations of why such measures would not be meaningful over time because of changes in project mix, contracting out, funding sources, and the like. These explanations may or may not be correct; the schedule for this evaluation did not permit the team to determine that.

This lack of performance measures is not unique to Caltrans. Government agencies in general, and at all levels, find it much easier to measure inputs—budgets, human resources—than to measure outputs. Our experience with private sector firms that have encountered the same initial litany of problems, however, indicates that minimal effort can usually result in measures accounting for most variances.

In particular, Caltrans' management measures appear to fall short in the tests of vertical integration, horizontal integration, as well as timeliness. These shortcomings include instances of not measuring at all, instances of measuring inappropriate indicators, and instances of measuring on an untimely basis. Some illustrations may help.

An example of the lack of timely measurement is drawn again from the area of project delivery. Project managers need timely project expenditure data to keep projects on budget—data that are not currently available until lengthy intervals (sometimes years) have passed. We understand that this problem is being addressed through improvements to the management information system (MIS) and endorse such efforts. We do, however, observe that this relatively recent attack on the problem indicates a prior attitude that assigned little importance to cost containment.

We expect that as measurement abilities expand, so will the setting of performance goals and objectives. These would contribute to enhancing management accountability.

Options

L3.1: Begin Piecemeal Improvements

The current weaknesses in measurement are sufficiently pervasive that Caltrans will require major expenditures in time and funds to remedy them in their entirety. A piecemeal improvement strategy that focuses on individual problem areas may therefore be most appropriate given the human resources and funds available to the department. In this option, measures would be developed to provide executive and functional managers timely performance information. (We assume that annual performance targets would be established as part of this process.) The need for similar systems for project management are identified in the Project Delivery section; the need for MIS support for such a process is described in the MIS portion of this report.

The advantage of a piecemeal strategy is that it will address the most pressing information requirements, permitting a rapid approach and a "quick fix" at relatively low cost. The disadvantage of piecemeal improvements is that the measurement creates standards—the means

to determine how well Caltrans is doing. If the standards are inadequate, efficiency and effectiveness gains from this process are lost.

L3.2: Institute a New Measurement Program

More radically, Caltrans could reevaluate applications and possibilities for both financial and nonfinancial measures department-wide. In concert with the analysis of the MIS system, Caltrans needs a diagnostic audit that identifies the information that management needs to manage the business. Appropriate, complete, and timely data should merge in an executive information system such that managers can look down and across the organization to isolate issues and problems. Such measures should, at the aggregate, apply to the department as a whole; at a disaggregate level, the measures should apply to divisions, functional units, projects and staff (managerial and rank-and-file) performance against targets.

Caltrans will need to obtain initial input, and later concurrence, on any recommended measures from policy entities (e.g., the governor's office and the legislature) that monitor Caltrans' performance. This concurrence is a key element of making the measurement system effective, as these measures need to become seriously established as the basis for assessing Caltrans' effectiveness. Without concurrence and support from policy-setting bodies, use of the measures will not be enforced, and they will fail to become the means for effecting change within the department.

The aggregate (department-wide) performance against budget should become the basis by which the agency, governor's office, and legislature assess the effectiveness of Caltrans' senior management. In turn, the performance of each lower administrative level for which standards are established, each project, and each employee is measured against their respective targets. With these measures, managers can track performance to date and take corrective action when unacceptable deviations from budget arise.

The advantage of a review of this kind is that it will introduce appropriate and timely measurement to Caltrans, which should result in dramatically enhanced potential to manage activities and significant cost savings. The disadvantage of this option is the staff time and cost of the design and implementation efforts.

Recommendations

Recommendations R7, R28, R55, and R61 need to be coordinated with this recommendation.

R8: Develop Appropriate Performance Measures

Our evaluation indicated that many aspects of Caltrans' performance are not tracked or measured; when performance is monitored, the measures are at times inappropriate. The lack of suitable performance measurement arises both from a lack of budget or standards with which to compare performance and a lack of timeliness in reporting. This problem is not unique to Caltrans; it can be found in many government agencies.

We recommend that Caltrans management undertake development of a department-wide set of performance measures. This set should reflect budgeted and programmed activities and

performance for Caltrans for the coming year and include absolute expenditures and ratios that can be tracked over time (subsequent years) to permit identification of improvements in output and efficiencies. (The ratio of capital outlay support to the capital outlay program could be just one of the many measures used, as could overall administrative expenses against capital and other direct expenditures.) Once the departmental measures are determined and agreed on as appropriate with policy-setting bodies, the measures should be expanded to establish division, functional unit, project, and individual staff targets. At all levels, accomplishment against these targets should become part of the annual performance and salary review process. The reporting cycle (weekly, bimonthly, monthly) for segments of these data should also be determined so that this information can be merged into an executive information system allowing managers to look down and across the organization to identify and isolate issues and problems as they develop.

We anticipate that in the first couple years, the set of measures will change somewhat as individual measures and ratios are found not to provide the expected incentives or information. The process needs to be continued through this trial-and-error stage until, eventually, a tool for assessing Caltrans' efficiency and effectiveness is created.

This recommendation will be enhanced by coupling it with the preceding implementation of the director's goals; changes in management and staff reward and discipline procedures; and MIS changes to permit the timely collection, processing, and dissemination of collected data.

Finding L4: Barriers to Change

> *Caltrans has had high turnover among directors who, on average, serve short terms of office. At the same time, the investigations of consultants dating back nearly 20 years conclude that work at Caltrans is slow paced, that extra steps are frequently taken, that work often exceeds budgets. Well-considered and frequently repeated recommendations, however, have not altered these conditions. A thoroughly bureaucratic ethos characterizes Caltrans. Change of any type within the organization is likely to be slow in implementation—a characteristic that we describe in part as "director surfing." It will require consistent direction over a significant period.*

The organizational structure of Caltrans is primarily a legacy from the past; the continuity of certain functions is evident despite frequent changes of form. Including changes in the job title of direct reports of the director or second-level reports, the department has undergone 17 organizational restructurings in the 1980-1992 period (see Table II-6)

Some individuals have survived this positional juggling. In the last 12 years or so, about 90 names occupy almost all of the 50 senior slots in Caltrans. New directors have only limited ability to change this situation. As only an extremely limited number of exempt appointments exist, the director cannot select many new people—just rearrange those that he or she inherits.

While this continuity provides a tremendous resource of organizational commitment and knowledge, it also contributes to the difficulty of bringing change to an organization that is rich in tradition and somewhat resistant to change. A quote on page 24 of the August 23, 1993 *Business Week* reflects the Caltrans problem: "This company (Kodak) is very much inbred," says Roberto Goizueta, a Kodak director and chairman of Coca-Cola. "That tends to accentuate the faults and also the virtues to the point where the virtues become faults."

Table II-6
ORGANIZATIONAL CHANGES, 1980-1992

Director	Date of Reorganization	Total Changes
A. Gianturco	March 1980	
	October 1980	
	November 1980	
	December 1982	4
L. Trombatore	June 1983	
	January 1984	
	June 1984	
	January 1985	
	August 1985	
	August 1986	
	February 1987	
	October 1987	8
R. Best	October 1988	
	July 1989	
	February 1991	3
J. van Loben Sels	October 1991	
	November 1992	2

Prior experience as well as expected and actual tenure in office markedly influence the potential of each Caltrans director to define and successfully pursue a strategy of change. Two of the permanent and interim directors of Caltrans since 1974 were transportation managers prior to their appointment. Others had varying degrees of relevant experience. Some had legal or general business backgrounds. Only two had engineering degrees.

Recent directors of Caltrans have manifest relatively short tenures in office. Since 1979, Caltrans has had four permanent and several acting directors. The appointment of interim directors reflects the slow pace with which incoming governors have identified, nominated, and won approval for directors of Caltrans. The mean tenure of office in this period approximates 2.5 years per director (the range is from less than 1 year to approximately 5 years), which may reasonably be considered too short a period for each director to complete a full policy-making cycle to:

- Shape mission, strategy, and policy statements for his or her term of office
- Ensure that these messages are diffused throughout the organization, that appropriate action plans to implement the messages are formed, and that the action plans are pursued.

The expectation that the Caltrans director should be acceptable to incoming administrations imposes limits on effective action. When a governor approaches the end of his second term and/or appears unlikely to win election to a second term, the director of Caltrans is viewed as a lame duck.

For these various reasons, Caltrans employees have developed an attitude characterized by one employee as "director surfing"; that is, if an employee does not care for the mission, vision, or policies of a particular director, he waits for the next appointee in the hopes of a more favorable environment. Not surprisingly in this context, statements of the mission, vision, and values are not highly regarded among many of the stakeholders we consulted—employees, vendors, CTC members, legislators, and staff. The ability of a new director to effect changes without sufficient time to follow through with implementation efforts does not reach deeply into the organization.

The previously cited frequency of reorganizations and short management tenure also inhibit the ability to implement the findings of management audits. There has been no shortage of such audits of Caltrans over the past 20 years. Examples are *Reducing Project Development Lead Time* (Discussion Draft, March 1973) and *A New Direction for the Highway Program* (July 1974) by McKinsey and Company; *The State's System for Planning, Programming, and Developing Highway Construction Projects Is Not Effective* (March 1983), Auditor General of California; *Review of the Department of Transportation's Highway Planning and Development Process* (June 1983) and *Final Report for the Caltrans 2000 Project* (May 1986) by Price Waterhouse; *A Report on the Planning, Operation and Funding of California's Highway System* (March 1988), and *Transportation: Keeping California Moving* (January 1992), all by the Little Hoover Commission; and *Getting the Most Out of California's Transportation Dollar* (October 1990), Senate Advisory Commission on Cost Control in State Government. In addition, the CTC has reported on numerous aspects of Caltrans' performance.

These audits have identified many of the same issues that are cited in SCR72 and that we encountered in our interviews. Difficulties with future fund forecasting, project monitoring and control, delegation of authority downward to reduce review/sign-off requirements, and the need for a long-range planning process (to mention a few) continue to recur. Lack of individual and functional unit accountability are major impediments to instituting reforms.

Options

L4.1: Improve Motivation

We see no evidence that a new organizational structure will change staff motivation from a process- to a responsive product-driven organization. Later in the Human Resource section of this report, we review the possibility of changing the monetary and nonmonetary incentives available to Caltrans employees. Such incentives are a more effective way to enhance the internal motivation of Caltrans staff. Relying on new organizational structures and external standards established by the legislature and governor's office (with little or no Caltrans staff "buy-in") are, as in the past, not likely to penetrate any deeper into the organization than the top management level.

Improvements in motivation are needed to yield tangible improvements in efficiency and stakeholder (or "customer") satisfaction. Institutionalized incentives (in the form of rewards and disciplinary actions tied to performance relative to budgets) are needed to support changes in the motivation of Caltrans management and staff.

Recommendations

Recommendation R8 coupled with **R16** should address this problem.

Finding L5: Professional Staff Planning at Headquarters Linked with District Workload Forecast

The process of professional staff planning relies heavily on PYPSCAN; indeed, until recent years, it was reportedly almost the sole basis for such planning. This process could be improved if a more balanced top-down and bottom-up approach were taken to staff planning, reflecting the types of skills, local measure work, and other information not captured by PYPSCAN that is known at the district level.

Our understanding of the capital outlay support planning process is that it is heavily oriented toward being a top-down procedure in which the PYPSCAN-derived staff requirements are allocated downward to the districts along with the capital outlay workload. This process could be improved by striking a more balanced top-down and bottom-up approach to staff planning, reflecting the types of skills, local measure work, and other information not captured by PYPSCAN that is known at the district level.

This process has been inhibited by the litigation-related implications of staffing forecasts and the desire to focus staff planning around well-documented bases such as the STIP. The passage of SB1209 could allow a more robust assessment of skill mix, as well as staffing levels, as it increased flexibility in the use of internal and external (contracted) resources. Unfortunately, as this measure is likely to be tied up in litigation for an indeterminate duration, this benefit is not likely to be realized in the next year (if at all).

As long as Caltrans management is constrained in its flexibility to openly match professional resources and workload forecasts, the system is likely to remain suboptimal. While complete flexibility would be unlikely (and highly undesirable from the standpoint of employees who would be the stakeholder group most affected), the greater the flexibility, the greater the potential savings.

Options

L5.1: Strengthen Top-Down and Bottom-Up Manpower Planning Process

Caltrans management could undertake a detailed review of the staff planning process. Such a study would identify whether district needs arising from the districts' view of future state-programmed and locally generated workloads meet the overall staffing levels as established at headquarters. The implications for professional and support skills by location need to be assessed.

We are aware that such a study could become a basis for legal challenges to Caltrans staff management practices if the planning process appeared to violate constitutional requirements for employee participation; such a study may be easier to conduct if a constitutional amendment allowing greater use of outside resources removed this threat to an honest and open evaluation of staffing needs and options. The need for such an amendment is separately discussed in this

report. Due to the strong positions that this issue is likely to raise internally and the need for objectivity, it may be appropriate to obtain an outside review of these findings.

The advantage of the recommended study is that it establishes an outlook against which future employee needs can be assessed. This outlook can be used in determining the mix of skills for hiring, as well as for identifying internal training that may be required.

The only disadvantage arises if the present process is already fully integrated (which we do not believe it is). If so, then the time and effort of the study will not further enhance the staff planning process.

Recommendations

Recommendations R64 and **R65** support this solution.

R9: Improve the Professional Staff Planning Process by Increasing Top-down and Bottom-up Integration

PYPSCAN provides a starting point for identifying staff requirements; the districts' perspective also includes requirements for measure work and other local support outside of PYPSCAN, as well as an understanding of modal and skill requirements. The personnel planning process needs to be strengthened with a better balance of top-down (headquarters) and bottom-up (district) inputs.

We recommend that Caltrans seek to improve the planning process. We recognize that inputs to any such efforts could become "discoverable" in the litigation between Professional Engineers in California Government (PECG) and Caltrans, and that Caltrans management may be reluctant to pursue this process improvement at this time. This improvement should be fully implementable once the contracting out litigation is resolved. This recommendation can be implemented as part of the project delivery plan implementation.

Finding L6: Need for Better Capital Outlay Support Accountability

> *Representatives of the legislature and their staff, executive branch staff, and CTC commissioners and staff have expressed major concerns about the lack of a clear and accepted analytical basis for establishing the size of the capital outlay support budget. Similar concerns are expressed with Caltrans' lack of measurement tools to monitor and manage capital outlay expenditures. Many of these issues are now being addressed by a Capital Outlay Support Task Force in Caltrans.*

The widespread concern regarding the method of establishing the capital outlay support budget is understandable given the fact that it represents a large portion of the Caltrans budget—$809 million proposed in FY1993/1994—and an even larger portion of the Caltrans workforce—8,800 person-year equivalents (PYEs) of state staff and overtime, and about 1,000 PYEs of engineering contracts. Those reviewing the budget and making decisions about it believe they do not have adequate means of determining whether the size of the capital outlay expenditures portion is appropriate. Many contend that these expenditures are excessive, a view supported by

published cross-state comparisons based on Federal Highway Administration (FHwA) data (which may or may not be valid).

The reliance on PYPSCAN as a basis for forecasting PYEs has little credibility. PYPSCAN is based on the elapsed time and the person-years that Caltrans personnel needed to accomplish project tasks in the past; however, PYPSCAN is used predictively or normatively to assess the person-years of effort required to accomplish future projects. Failing to recognize differences in productivity over time, using "actual" performance to generate a standard for or "budget" of performance is seen as a static approach to staff allocations. Similarly, the inability to forecast staffing needs by project and the inability to report actual versus budgeted performance on a project basis frustrate the legislature and CTC in their efforts to obtain meaningful accountability of Caltrans' substantial professional resources. A system such as Washington state's Transportation Executive Information System (TEIS), which reportedly allows the governor and any legislative or transportation department employee to access on-line status and budget information for any highway project in the state, would be helpful.

The Caltrans director has stated that information management is a major issue for him and has taken a number of steps to address the issue. Among the steps taken that relate directly to capital outlay support is the establishment of a Capital Outlay Support Task Force. According to Caltrans, this task force along with the Data Analysis and Control Branch have developed or assisted in developing a series of cost accounting monitoring reports to enable management to track cost by employees on a year-to-date, project-to-date, and month-to-date basis and to better manage capital outlay support cost. Many of these reports were reportedly used by the task force in training the districts and are reportedly being used for ongoing monitoring of capital outlay support expenditures.

A Caltrans memorandum lists as the accomplishments to date the following:

- Defined the financial cost structure for capital outlay (C/O) support for better overall management of overhead, project, and owner operator charges.
- Developed a training guide for C/O support and provided training to more than 200 district and headquarters trainers. The trainers are expected to train the balance of C/O staff.
- Developed monitoring reports.

The memorandum lists as "Work in Progress" the following:

- Develop monthly management C/O status reports
- Define the financial cost structure for the rest of the department's programs, provide training, and develop monitoring reports
- Revise the labor cost activity code structure.

A limitation with the task force approach is that it appears to be focused on monitoring and managing capital outlay expenditures and not on the related issue of developing the analytical framework for establishing the capital outlay support budget. (Such a policy area would be outside the scope of an internal team.) The responsibilities of the task force could conceivably be expanded; yet, even if they were expanded, this option would not provide an analysis

independent of Caltrans itself and, therefore, might not be accepted by those who are particularly vocal in their criticism of Caltrans in this area of capital outlay support accountability.

One fundamental aspect of the problem is that capital outlay support expenditures are budgeted annually, while the capital expenditures are identified in the multiyear STIP. This difference decouples capital outlay support commitments from the capital outlay commitments themselves, reducing accountability of the former on a project-by-project basis.

Further difficulties developing an objective basis for estimating the capital outlay support budget—one that would ensure an efficient allocation of resources—and monitoring performance relative to budget are addressed in our discussion of project delivery issues.)

Options

L6.1: Obtain an Independent Assessment for Developing a Framework

In this option, the legislature would commission the Legislative Analyst's Office (LAO), CTC, or an outside consultant to develop an overall analytical framework for establishing the capital outlay support budget and to provide a report to the legislature regarding the framework. Such a framework would provide standards for support estimates related to capital project expenditures. If the new framework were approved, then Caltrans would develop procedures to implement it by changes in PYPSCAN and elsewhere in project budgeting activities.

A key advantage of this option is that it would provide the independent analysis that might satisfy Caltrans' critics. The disadvantage is that it could become a costly exercise with uncertain results. The LAO and CTC likely do not have the resources or data base to conduct such an assessment on their own, so use of an outside consultant is likely. Data available to such a consultant could be challenged for its relevancy to the mix of activities Caltrans undertakes, and its recommendations challenged and deferred as inconclusive.

L6.2: Combine Capital Outlay Support and Capital Outlay Budgets in the STIP

Another approach to improve capital outlay support accountability is to couple the capital outlay support with the capital outlay expenditures. Thus, capital outlay support estimates would be provided for in the STIP, although not programmed. They would continue to be appropriated annually, with cumulative records kept by project; over time, a data base would be established of capital outlay support requirements for diverse types of Caltrans' capital projects. Improvements in the ratio of capital outlay support to project requirements could be incorporated into the budget in successive years to increase efficiency of these expenditures.

The advantage of this approach is that it couples capital outlay support and capital estimates to provide a broader accounting of overall project costs. The disadvantage is that any inefficiencies now in the capital outlay support estimates would continue for several years until the process of decreasing the level of support to capital outlay (if sought by the legislature or governor's office in the budgeting process) squeezes out the excess.

Recommendations

R10: Modify PYPSCAN to Provide Greater Accountability

PYPSCAN has little credibility as a tool for predicting professional staff support requirements for capital outlay projects. PYPSCAN could be modified to better reflect the variability of current project types, services, and management practices at Caltrans. An improved management information system should aid the process of compiling the data necessary to make these changes.

R11: Include Capital Outlay Support Cost Estimates in the STIP

Caltrans should include capital outlay support costs to supplement capital outlay estimates in the STIP. These estimates could incorporate PYPSCAN-generated estimates, with appropriate adjustments based on knowledge of individual project requirements, or other measures developed for this purpose. By coupling capital outlay support estimates with those of capital outlay, the total costs of project development can be monitored and efficiencies assessed.

FINANCIAL

Finding F1: Reductions in Capital Outlay as a Result of Expanding Maintenance, Rehabilitation and Administrative Expenses

Before funds are programmed in the STIP for capital outlay, other expenses are first deducted. As a result, funds available for capital outlay become the amount remaining after these other "off-the-top" commitments are made. The relationship of capital outlay to these other accounts needs to be viewed in a manner that reflects overall system needs as well as the priorities assigned to the individual accounts.

Maintenance, rehabilitation, operations, local assistance, and administrative funding all have higher priorities in the STIP than do capital outlays. As such, these are said to come "off-the-top" before funds for capital outlays are programmed. Maintenance and rehabilitation are determined by program (in some cases, statutory) requirements, while the capital program is determined by fund availability.

As expected revenues fluctuate through economic downturns, program changes, adjustments in annual obligations, and the like, peaks and valleys develop in the amount programmed for capital outlay. Programming staff resources and smoothly delivering projects in this saw-tooth delivery stream becomes impossible. The resultant project delays lead to increased costs, frustrated local expectations, and an overall decrease in the capital outlay program's size as funds lost in one STIP cycle are rarely (if ever) recouped in later cycles. The overall (perhaps, lifecycle) needs of the highway system as a whole are not explicitly considered by this approach.

Options

F1.1 Assess Overall Capacity Expansion/ Rehabilitation/ Maintenance Requirements

While not yet a major issue, the balancing of funding between capacity, rehabilitation, and maintenance requirements is expected to become increasingly problematic through the decade if the purchasing power of SHA declines as discussed in Finding P3. The problem will be intensified if the maintenance and rehabilitation needs of the highway system increase as roads continue to surpass their initial design lives.

If this problem of balance is to be addressed, overall highway system needs should systematically be evaluated to forecast the capacity, rehabilitation, and maintenance needs, and then considered in light of the projected funding available. While Caltrans could undertake much of this effort, it should have broad, statewide input. As a result, including this evaluation in the Statewide Transportation Plan appears appropriate.

Recommendations

All recommendations that lead to improved administrative efficiencies at Caltrans also contribute to this finding as they reduce the funds that come off-the-top before capital outlay funds are programmed.

R12: Extend the Statewide Transportation Planning Process: Evaluate the Appropriate Balance of Capacity Expansion/Rehabilitation/Maintenance Expenditures

We recommend that an overall assessment of capacity, rehabilitation, and maintenance requirements be undertaken as part of the CTP effort and that this assessment be used in the debate of fund requirements (Recommendation R3) The key issue is that adequate funds for capital expansion be available after the maintenance and rehabilitation needs of an aging and expanded state highway system are met. The inclusion in the CTP is necessitated by the need for broad input and discussion of the issue, particularly as it relates to the overall financing needs of the state highway system.

Finding F2: State Highway Account (SHA) Cash Management

Over the past 5 years, the cash balance in the SHA has ranged from a high of $768 million to a low of $174 million. Based on our analysis of constant-dollar fluctuations in receipts and disbursements to the account, we recommend that a balance of $100 million (1993$) be established as the target level if no major changes to receipts or commitments occur.

When SCR72 was enacted, the cash balance in the State Highway Account was approaching $800 million; since that time, it has fallen substantially and is expected to continue dropping through 1993. The problem posed to the study team is to identify an appropriate level for this cash balance.

We obtained data on receipts, disbursements, and changes in monthly cash balance in the SHA from January 1988 through June 1993 (66 months). During these years, the actual balance ranged from a high of $768 million to a low of $174 million. To make the multiyear data comparable for analysis, we have adjusted the changes in monthly balance using the California Highway Construction Index to obtain a constant dollar perspective (see Figure II-6). We then analyzed the resulting data to determine the frequency with which various levels of cash balance would be (in)adequate to meet monthly needs. As indicated, a cash balance of $200 million (in 1993 dollars) would be adequate to accommodate most normal fluctuations in receipts and disbursements assuming that historical patterns continue. With present management practices, we would expect a balance of $200 million to be exceeded less than 1 month each year. Such a situation could likely be avoided by minor changes to present management practices. In addition, a balance of $100 million would be exceeded about 1 month each year. (The greater frequency shown in the figure is due to recent efforts to draw down the balance.) In the latter case, present practices used to manage receipts and disbursements would still accommodate the need to keep the account solvent.

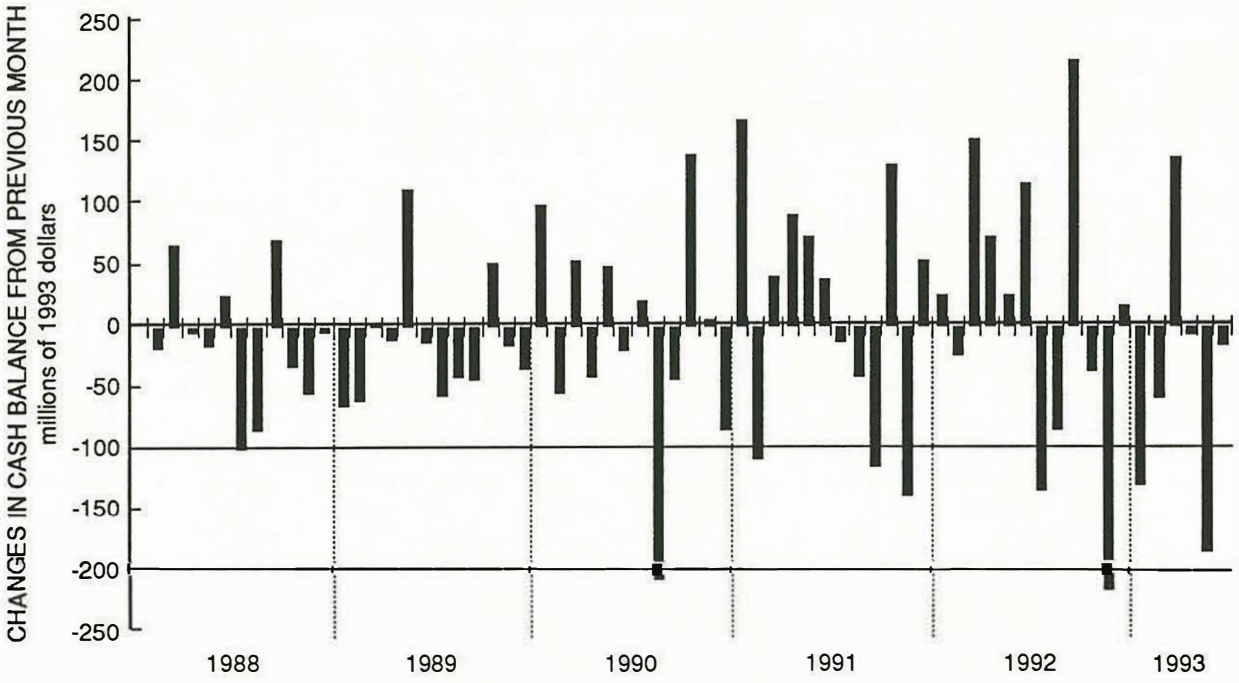


FIGURE II-6 MONTHLY CHANGES IN SHA ENDING CASH BALANCE (CONSTANT 1993 DOLLARS)

A more aggressive cash management practice could be instituted to lower the balance below $100 million. In such a case, a variety of mechanisms could be employed such as:

- Delaying payments (to contractors and local governments)
- Borrowing cash from other funds
- Issuing short-term notes
- Managing federal accruals at a lower level.

These mechanisms, however, require consideration of legal, political, and managerial issues, as well as the obvious financial ones. Perceived slow payments is already an issue for which Caltrans receives some criticism; if fund management were too aggressive (seeking a very low balance), this problem would be exacerbated. Borrowing and issuing notes may require legislation and budget authorization; in either event they increase the cost to Caltrans through the need to make interest payments. Managing federal accruals to a lower level could limit Caltrans' ability to fund new projects. In addition, the more aggressive the cash management, the greater the staff commitment will be to this activity (drawing resources away from other areas of Caltrans' commitments). Improving forecasts of receipts might be possible; such an action will, again, require greater commitment of staff resources.

We believe that a balance of $100 million can be accommodated with minor changes to existing SHA cash management practices as long as receipts and commitments more or less retain their historical balance. We cannot recommend a balance less than $100 million without a

more detailed review than permitted herein of current SHA cash management practices and an assessment of adverse effects on local finances of more aggressive cash management practices.

Options

F2.1 Adopt Appropriate Changes to Procedures

In this option, Caltrans management would review our findings and report their conclusions to the appropriate legislative committees. Once an appropriate target level is established, Caltrans could provide a one-page summary report annually to the legislature and/or CTC on attaining the target.

The advantage of this approach is that it maximizes the funding of transportation projects without jeopardizing the solvency of the state's accounts. The disadvantage is that possibly 1 month a year (depending on the ability to forecast receipts and disbursements 1 to 2 months in advance), Caltrans will need to curtail disbursements to keep the SHA solvent; this action may generate complaints to legislators from local governments, agencies, or private contractors inconvenienced by a delayed payment. The absolute level would also need to be periodically reviewed to determine whether changes in federal reimbursements, commitment requirements, or other factors have changed the nature of the historical relationships on which this recommendation is based.

Recommendations

R13: Reduce State Highway Account Balance

Over the past 5 years, the SHA cash balance has fluctuated from a high of $768 million to a low of $174 million. An analysis of receipts and disbursements indicates that a balance of $100 million would likely be exceeded about once a year (on average), assuming historical variations and the flow of funds and cash management practices.

We recommend that Caltrans establish a $100 million balance as a target. If substantial changes in the flow of funds occur or are reasonably anticipated, then the balance would rise to accommodate the anticipated changes. Legislative recognition of this action is needed; if cash management efforts (that is, delay of disbursements to contractors or local governments) must be increased to prevent the fund from becoming insolvent, then the legislature needs to understand why this has occurred and to redirect Caltrans if appropriate.

Finding F3 : Grant Administration Management Weaknesses

A recurrent complaint of local governments and others dependent on Caltrans administration of programs and pass-through of funds is the disproportionate effort required to obtain grants. An assessment would help determine whether changes in grant procedures (such as minimum size standards or simplified application procedures) are required to prevent the costs of application and administration from becoming disproportionately large relative to the size of the grants awarded.

The amount of funds expended on transportation program that are channeled through grant programs have increased sharply in recent years with *Blueprint,* Proposition 116, and ISTEA legislation. A dozen grant programs can be identified, including:

- Proposition 108 rail bond for urban and commuter rail
- Proposition 116—Rail bonds
- Proposition 116—Nonurban
- Proposition 116-- Bicycle
- Proposition 116—Ferry service
- Environmental Enhancement and Mitigation (EE&M) program
- Traffic Systems Management (TSM) program
- Flexible Congestion Relief (FCR) program
- Aeronautics' airport support
- Transit Capital Improvement (TCI) Program
- Transportation Enhancement Activity (TEA)
- State-Local Partnership program.

This growth in grant programs has been accompanied by a frustration with Caltrans' grant administration procedures repeatedly encountered in our interviews, both inside and outside the department. Outside entities made adverse comments about Caltrans' ability to commit grant funds in a timely manner, to monitor grants awarded, and to report on the use of the funds. Although Caltrans has sought improvements in this area, the extent to which information is thoroughly and timely assembled and reported is unclear to us. Some Caltrans' staff suggest they are "overqualified" to perform their activities; professionals believe they are performing essentially clerical work.

Options

F3.1: Improve Grant Administration Management

More information needs to be developed on the cost and timeliness of grant administration relative to the size (dollar value) of the grants themselves before specific procedural recommendations can be made. This information can be compiled by monitoring or sampling the administrative effort expended on grants in a variety of the programs identified above. This monitoring (or sampling) should include information on Caltrans' costs of administration, as well as the costs to grant recipients for application and administrative activities. If it appeared that administrative costs (Caltrans and recipient) were a substantial portion of smaller grants, then procedures to simplify administration and/or monitoring should be developed, or the smaller grants should be consolidated or eliminated. Whether the cost-effectiveness of expending a significant share of grant amounts in administrative costs (in order to avoid compliance problems with the low percentage of grants that develop problems) has become a problem also needs to be assessed.

Such a review of grant administration should also identify the required training and background of persons involved in grant administration. Whether the positions are appropriately matched to the required skills needs to be determined.

Recommendations

R14: Undertake a Focused Review of Grant Administration

We recommend that a review of the grant administration process be undertaken with the goals of determining the timeliness of grant awarding (relative to CTC allocation), the overhead expenses incurred by both Caltrans and recipients in obtaining and administering the grants, and match of skills held by and required by Caltrans staff involved in grant administration. Such a review should focus on grants of various sizes in the different programs. Revisions to procedures should be developed as appropriate.

Finding F4 : Review Caltrans' Billing Rates for Competitively Bid Work

> When Caltrans undertakes outside (for example, measure-related) work, it does so charging hourly rates based on direct (labor and benefit) costs multiplied by a factor for overhead and administrative costs, as do private sector firms. If increased competition is to be sought with the private sector for internal design work, then billing rates will be crucial to fair competition. Without fully loaded billing rates for Caltrans (including all overheads and administrative costs), the incentives to achieve increased efficiencies is reduced.

Caltrans presently bids on local measure work at the behest of local agencies, incorporating indirect overhead recovery factors in its pricing structure to reflect direct (salary and benefit) costs and to recover indirect costs such as overhead and administrative expenses that are a normal part of conducting their business. Caltrans' overhead assessment rates (the overhead factor applied to direct costs) varies from 33% for traffic operations to 70% for project development and 80% for right-of-way related activities.

The question of billing rate completeness takes on increased importance as we seek to expand Caltrans/private sector competition as a means of enhancing the department's overall efficiency and effectiveness. As project managers become responsible for the time and budget of deliverables, they should have the flexibility of using either internal or external resources on a competitive basis. If design groups are to bid on projects, then internal (transfer cost) bidding rates need to be established that reflect total costs to the state. If Caltrans' units were not bidding using total costs, effective economic competition would be reduced and pressure to improve efficiency would be mitigated.

The question of whether Caltrans should use an hourly billing rate reflecting total costs has significant policy implications. On the issue of support for other governmental entities and enabling them to extend their budgets, anything less than full cost recovery can be justified as providing counties a low-cost means of obtaining engineering services. In effect, the state may choose to subsidize the overhead and administrative components of the measure work.

Options

F4.1: Review Billing Rates to Determine if They Reflect Fully Allocated Costs

To enforce the need for increasing internal efficiencies, Caltrans could be required to use billing rates that reflect total (direct plus indirect) costs in undertaking outside work. When in the future Caltrans units bid on internal work (in competition with contracting-out), these same billing rates could be used. The objective of this approach is to force Caltrans units to increase efficiencies through competition with private sector firms seeking the same work.

To implement this option, however, an appropriate entity needs to establish a billing rate that fairly represents the total or fully allocated costs of its efforts. To this end, as part of this option, the Department of Finance could review Caltrans' cost structure and activities and review the present overhead and administrative factors that are applied to various Caltrans functions.

Although the Department of Finance could determine the rates, we believe that an independent review of the methodology, data, and results is appropriate because the department will likely need to rely on Caltrans' assistance. We suggest that an independent accounting firm review the findings or, as a minimum, they be reviewed by the Auditor General. The resulting rates would be used for billing external work. Later, these could also be used for establishing the costs for bidding internal work when such work is opened to competition. These rates would be recomputed on a periodic basis (e.g., annually).

Recommendations

Recommendations R17 and R58 also relate to this finding and recommendation.

R15: Establish Billing Rates for Caltrans Reflecting Fully Allocated Costs

Competition is the primary means for enhancing Caltrans' efficiency; as long as the department remains a monopoly as a protected provider of services (e.g., engineering, maintenance), we anticipate no impetus to increase efficiency and effectiveness throughout the organization. We see no other realistic way to motivate the desired changes. Yet, until Caltrans begins to compete with private sector firms on a more or less level playing field, there will be little pressure for increased efficiency.

To establish real competitive pressure on Caltrans management and staff, we recommend that billing rates be established for outside work that reflect the fully allocated costs to the department of the work undertaken and that Caltrans be required to use these rates. We further recommend that these same rates be used as an internal rate when Caltrans' design work (and other activities such as maintenance) are opened to competition with private firms through expanded contracting out.

To implement this recommendation, the Department of Finance should evaluate Caltrans' cost structure and review the present billing rates, which should reflect fully allocated costs for their completeness in current categories, as well as others such as maintenance that could be bid externally. An outside auditor should then review these findings. The findings should be reported to the governor's office, the legislature's transportation committees, Caltrans management, and the CTC.

HUMAN RESOURCES

Finding H1: Need for Individual and Group Performance Awards

Caltrans offers little formal incentive for employees to excel. This problem is not unique to the department, but one common to government civil service systems in which both rewards for exemplary behavior and below-average pay raises or other disciplinary actions for substandard performance are generally avoided. Effective performance incentives and disciplinary procedures are required.

Caltrans shares many characteristics with large government bureaucracies, including a generally risk-averse mode of professional behavior and a lack of strong differentiation in performance awards. Exemplary performance is only mildly rewarded, and marginal performance is only mildly punished; no strong incentive for above-average performance exists at either the individual or functional unit level. Risk-taking that fails is far more devastating to an employee's career than the benefits gained from successful risks taken; the major asymmetry between risks and rewards reinforces risk-averse behavior.

The perceived outcome of these characteristics and the previously described attitudes and culture (L3, Inadequate Performance Measures and L4, Barriers to Change) is that decision-making occurs at a pace that frustrates stakeholders by its slowness and becomes primarily focused on rule compliance rather than product delivery or customer satisfaction. Many Caltrans employees who recognize these issues insist that external forces—legislation or litigation or unionization—are the sources of the orientation and pace at Caltrans. The essential question is how to reward performance and offer incentives for appropriate risk-taking to change these orientations. Two specific areas where procedural changes could be sought are those of employee evaluations and examination scoring.

Employee Evaluation Procedures. After completion of one year in a position, employees receive a merit salary adjustment (MSA) if his or her performance meets a standard of efficiency as prescribed by the department. An MSA is equivalent to one step in the salary range and is awarded every year until the maximum salary range is achieved within a job classification.

Under current procedures, however, if an employee has not met the performance requirements for the position, management may deny award of the MSA. The employee has the right to appeal the case before the department and the Department of Personnel Administration (DPA) for a change in action. The grievance procedures as outlined by the DPA are designed to protect employee rights; nevertheless, the process can be very acrimonious and time-consuming (up to four levels of arbitration), in addition to placing responsibility on management to justify cause for nonaward.

The consequence of the current practices for salary adjustment is that management has little effective latitude in which to evaluate employee performance effectively. Although they have the prerogative to deny an MSA, the reality is that managers infrequently take this recourse

because of the time burden involved. Employees automatically receive salary adjustments without going through any real evaluation measures of performance.

An estimated two-thirds of all civil service employees have already reached their maximum salary rate. Salary increments thereafter are determined through the collective bargaining process, which may or may not be awarded on an annual basis. The only input management has to distinguish employee performance is through the superior accomplishment awards that can be given to employees for sustained extraordinary performance. The pool of funds for these incentive awards, however, is limited. Moreover, the general guidelines for such recognition awards are defined in legislature rules of the DPA.

Examination Scoring Procedures. Current personnel procedures require that competitive, job-related examinations be taken to determine the qualifications of applicants for employment and promotion. In addition, the evaluation process must include affirmative action measures. (A promotion is defined as the appointment of an employee to a position in a different job class with a higher salary range.)

The list of procedural requirements to be followed for any employee promotion is long and rigid. Examinations are only given when there is a sufficient list of qualified candidates, and the tests may be of many different kinds (oral, written, or a combination of both). The evaluation criteria are determined by the department issuing the exam; however, the State Personnel Board provides very specific procedures for ranking and scoring of applicants. Among the scoring criteria are preference points given to veterans (including widows or widowers of veterans, and spouses). In the case of a tie on an examination, the decision is given in favor of veterans and widows or widowers of veterans.

While meeting other (social) criteria, the examination process may not be the most effective and efficient method to validate an employee's true capability to perform the required job. The entire process appears rigidly defined by rules concerning who can take the exam, how the exams are scored, and if affirmative action goals are met; little latitude is allowed for subjective management appraisal of performance and contributions. This examination process for promotions, needless to say, is not unique to Caltrans but applies throughout most local, state, and federal civil service systems. Nonetheless, its widespread use does not address its contribution to efficiency or effectiveness of performance.

Options

H1.1: Establish Performance Awards Entailing a Minor Relaxation of Civil Service Rules

After Caltrans management and the Department of Personnel Administration (DPA) review the options, we recommend that an incentive program be developed. Such a review should seek to identify the criteria and guidelines for such a program (and relate these to the individual goals described in Recommendation R8), the latitude for changes permitted by current legislation, and changes that could be effected with new, special-purpose legislation. This awards program need not affect the budget because funding would be drawn from Caltrans' budgeted salary increases.

As part of this option, DPA procedures pertaining to merit salary adjustments could be reexamined to reduce the barriers to effective employee evaluation. A process could be

developed that allows management to provide input into the process. In conjunction with a review of the MSA, procedures for denying a merit adjustment should be streamlined or eliminated.

The advantage of this approach is that it allows distinctions to be made in level of performance. The net effect would be to reward those individuals and groups that performed in line with established criteria and to reduce the financial benefits of Caltrans' employment for those who failed to meet their annual goals. The major disadvantage is that implementing these changes and making them an enduring part of department practice will require sustained political attention and pressure.

H1.2: Establish Performance Awards Entailing a Substantial Relaxation of Civil Service Rules

Performance awards could be included in any package of options that establishes new, nonbureaucratic redesign of Caltrans' processes. In such a case we would expect a substantial relaxation of existing civil service rules. As in the preceding option, the criteria and guidelines for such a program should relate to the individual goals described in Recommendation R8 and changes that could be effected with new, special-purpose legislation. The difference between this and the preceding option is that changes under this option would entail a greater deviation from current practice and would likely, as a result, require more complex legislative changes.

DPA procedures pertaining to merit salary adjustments, for example, should be reexamined as described in the preceding option. Under this option, however, a process could be developed that actually allows management to evaluate employee performance and to determine salary increments, instead of merely providing input into the process. As above, procedures for denying a merit adjustment should be streamlined or eliminated. Further, promotion without examination could be considered. The current practice is too constrained to allow effective management and choice of personnel. If removing the examination process is not a viable option, then the scoring process should at least be reviewed. A new scoring procedures could be adopted that is based on qualifications and eliminates preference points to underrepresented groups, including veterans' preference credits.

Recommendations

Recommendation R8 supports this finding and recommendation.

R16: Seek Opportunities to Provide Monetary and Nonmonetary Rewards and Disciplinary Actions

We recommend that opportunities for monetary and nonmonetary rewards be sought to recognize outstanding individual and group performance and that disciplines (holdbacks) be sought to respond to below-par performance. We recognize that the current system allows for salary increase differentials based on performance differences, but we are also aware that these are rarely used outside a very narrow range to avoid acrimonious and time-consuming appeals. Thus, to implement this recommendation, Caltrans needs to selectively relax traditional civil service rules to increase management authority in making award and disciplinary decisions. We recommend strengthening management's involvement in the employee evaluation process and

salary determination; further, we recommend that appeal procedures for denying pay adjustments be streamlined and reduced.

This recommendation needs to be implemented in conjunction with those that seek to improve performance measurement in general. Goals must be clearly articulated to individuals and groups, and the means to measure performance against these goals must exist before this recommendation can proceed. It is clearly our intent to give managers more latitude in the promotion and salary process; however, these managers themselves are being evaluated on the performance of their unit. The frequently voiced concern with manager's "playing favorites" cannot be sustained if their unit becomes less productive as a result.

Finding H2: Obtaining Efficiencies and Cost Reductions Through Contracting Out

The question of whether Caltrans should (or legally can) contract out engineering design and other technically specialized work and what benefits would accrue to the state from such a practice has been argued in several studies and in the courts. SB1209, enacted in September 1993, provides the department new latitude and flexibility to meet its project delivery commitments in a timely manner with the use of contract assistance. Beyond this bill, however, remains the provisions of Article VII of the state constitution protecting state employee rights to undertake work for which they are capable.

Our findings indicate that studies produced to date on the cost-effectiveness of contracting out have been sufficiently flawed that no definitive answer is yet available; no study has shown that contracting out will or will not be more cost-effective for the state. In addition, workload forecasting is subject to much variability because of funding and project delivery uncertainties. In such an environment, flexible staffing is an appropriate strategy.

For most of the history of highway development in California, state employees conducted planning and engineering design work. In the mid-1980s, in an effort to help constrain growth of overall state employment despite an overall increasing workload, Caltrans began contracting out engineering work to private firms. Beginning in 1988, lawsuits between PECG and Caltrans have attempted to resolve the legal basis for contracting out. The major dimensions of the dispute are between the need to adjust staffing on a short-term basis to meet unusual circumstances to achieve efficiencies and economies, and the need to maintain the integrity of the civil service and the rights of state employees as protected by Article VII of the California constitution.

Both state legislation and Judge Eugene Gualco's 1990 ruling acknowledge that under certain circumstances contracting out is allowable, but certain criteria must first be met. This principle was affirmed by both PECG and Caltrans in their May 3, 1991 agreement. In general terms, contracting out is acknowledged as a reasonable alternative in circumstances when timeliness and/or short-term peaks drive workload demand so that short-term hiring and layoffs can be avoided. However, the two parties have not agreed on the definition and identification of what constitutes a short-term peak, the cost impacts of contracting out, and the policy implications.

In 1992-1993, Caltrans contracted out approximately 12% (1,285 PYEs) of the total PYEs for capital outlay support staffing. When compared to only the PYEs that could be contracted out (and not to all capital outlay support PYEs), the contracted-out PYEs as a percentage of the total is about 20% to 25%. Prior to the dispute between PECG and Caltrans, in FY1993/1994 the total capital outlay support staff PYEs was expected to fall 5% and the contracted-out portion was expected to decrease to approximately 11% (1,140 PYEs). The annual magnitude of the contracting-out effort (if allowed to proceed) is presently about $150 million.

Workload Requirements. The STIP and other capital programs identify for Caltrans a 7-year capital outlay support requirement. Yet all the funding uncertainties previously discussed and more now come under legal scrutiny, as does the ability of Caltrans to modify project delivery scheduling by accelerating work. In the words of Judge Gualco, "The workload projections on which the 92-93 determination (is based) have questionable value as predictors of future workload." (*Professional Engineers in California Government v. CALTRANS [1993]*, No. 336697; May 18, 1993). Requirements for seismic retrofitting of bridges following the 1989 Loma Prieta earthquake and the projected workload required by projects reimbursed by others (such as those financed by local sales tax revenues) compound the uncertainties already inherent in SHA, bond revenue, and, as a result, manpower forecasting.

Cost Impacts. A major dimension of the contracting-out dispute is the debate about the relative cost advantage to Caltrans of using in-house staff versus the use of external consultants. Three major sources are cited, yet all are inconclusive. The advantage (or disadvantage) remains unproved.

The first source is LAO's calculations based on Caltrans' budget data. LAO estimates that each person-year of engineering work costs $124,000 if contracted with a private engineering firm. By comparison, a Caltrans engineer who undertakes the same work is estimated to cost the state $75,500 for a person-year.

While others have quoted these annual costs, assessing what they really imply is difficult. The variable overhead costs included or excluded for the Caltrans engineer are not known, nor are the dollar (not to mention personal) costs of hiring and laying-off if the professional is needed for only a short time. Conversely, the additional costs to Caltrans to contract for and monitor the work of an outside contractor are not included. Equal productivity is assumed; we have no way to test if that is reasonable in this comparison of annual rates.

The second source cited is *A Cost Comparison of Contracting Out for Engineering Services by Caltrans Versus Inhouse Engineering* published by the University of California at Berkeley, June 30, 1992, under the authorship of David B. Ashley, Principal Investigator. Our brief review indicates that this study falls short of delivering on its goal (broadly defined) in a number of ways. Foremost, a study methodology identifying all elements of importance to answer the question is lacking. Not included are measures of externalities such as measures of efficiency and quality of contract services, or hiring and lay-off.

The study was initially intended to evaluate marginal costs of contracting out, but was redirected to use total cost information instead. Hence, the reader cannot draw any conclusions on the marginal cost impacts of contracting out. The study relies heavily on overhead cost comparisons (based on a limited sample of projects [36] as the only ones with sufficient data to analyze). We do not have confidence in the accuracy of the conclusion reached on such a narrow base.

It has been cited that studies from numerous states conclude that outside consultants cost more than in-house staff. We have not had occasion to review these studies to determine whether the methodologies were more (or less) complete than the Berkeley study. Despite these studies, many of these same states continue to contract out engineering services. Florida contracts out 70% of its engineering design work, Illinois 50%, Texas (with in-state studies showing higher costs of contracting out) 25%-30%, and Washington state 10%. (The present budget level would represent approximately 12% in California.)

The third study evaluates the cost of contracting out on more than a marginal basis: *The Effect of Contracting Out on Engineering Costs* by William F. Fanning, September 1991. This study uses FHwA data supplemented by data obtained from state DOTs to analyze expenditures of preliminary and construction engineering (PCE) costs among the states in relation to budget size, contracting-out practice, and other factors such as mileage and geography. The findings indicate that states that contract out between 50% and 70% of their engineering work (which does not include California) have achieved the lowest PCE cost as a percentage of construction over the past 11 years. It further concludes that states with less than 10% contracting out consistently have the most expensive PCE. The author concludes that from 1979 to 1989, California spending totaled $1.7 billion more than if spending were at the average engineering cost level for the 49 other states.

Critics of the Fanning report have made several observations, the most common of which is their questioning the consistency of the data reported by the state DOTs to the FHwA. Despite FHwA efforts to establish categories and definitions, critics point to the fact that different state accounting systems simply do not provide the information in a manner sufficiently uniform for the analysis undertaken to be meaningful. For example, California is noted to report more items as engineering costs than any of 14 other states contacted—portions of what in California is construction engineering costs are elsewhere reported as administrative expenses or as highway (capital) construction. Within the scope of this review, we have not been able to validate the criticism of the report.

Policy Implications. Contracting out can also reflect political or staffing philosophies. An approach to government that would maximize private sector participation to achieve anticipated efficiencies will favor increased contracting out; such a view has been espoused by several interviewees. The cost impacts of such a decision (one that might involve a high percentage of the workforce) are likely to be entirely different from the marginal costs of contracting for a single engineer (or even 12% of the workforce); direct and variable cost allocations, among others, would be entirely different. In addition to the obvious questions of efficiency, flexibility, and productivity, questions about staffing to guarantee oversight to meet federal and other statutory requirements need to be included in any evaluation of the economic benefits of this approach, as would questions of the partner or adversarial attitude of those providing the oversight.

Options

H2.1: Continue Studies of Benefits/Adverse Costs of Contracting Out

In this option, Caltrans would undertake further studies of the economic and programmatic advantages of contracting out. The advantage of this approach is that in the short term it

introduces the least change in Caltrans' operations. The disadvantage is that we have little confidence that such a study could garner the necessary support from all parties concerned. If contracting out were proven to be more cost-effective than continued use of internal resources, then the study process would have deferred its implementation.

H2.2: Develop a Contracting-Out Experiment

In lieu of studying the economics of contracting out, a 3- to 5-year experiment could be developed to assess its advantages. In such an experiment, a target level of contracting-out effort large enough to encompass a widely diverse mix of activities (e.g., 20% to 25% of workload) could be established and the process monitored and evaluated. Based on the evaluation, the level would be increased or decreased.

The greatest difficulty in implementing this option will arise in designing the experiment—that is, in determining what is to be measured and assessed, and by whom. Caltrans' professional staff face a potential conflict of interest in being asked to assess contractor performance, yet their input will be vital. Similarly, the data to be collected regarding internal costs and external (contract) costs need to be identified in advance, and procedures established to ensure that they are accurately entered and recorded. Our findings suggest that internal time charges do not always accurately reflect actual project performance, nor are the systems for maintaining this information always capable of generating summaries in a timely manner.

The advantage of this approach is that it allows for a fuller assessment of the department/contractor dynamics and economic impacts than could be anticipated in just a study of the issue. If contracting out proves to be more cost-efficient, then some of its advantages are obtained.

A disadvantage arises if contracting out proves to be a more costly means of delivering projects; in this case, extra costs are incurred for contractor services.

H2.3: Establish Contracting-Out Goals as a Policy; Seek a Constitutional Amendment

Analysts of government contend that many of the means by which governments at all levels approach their objectives are increasingly inadequate and that the cost-effectiveness of government outputs is frequently not measurable. These theses have led to a move to "reinvent" government whereby improved services and reduced costs are obtained through greater accountability and competition.

In line with this approach, and lacking definitive evidence to indicate that greater costs would be incurred by contracting out, the state could establish contracting out of engineering and other professional services as a policy goal. Caltrans might provide a starting point for such a process as many of its functions are duplicated in the private sector.

To reduce state staffing in this area, however, a constitutional amendment will likely be required. If staffing were held at present (or 1986/1987) levels, the need for such an amendment is not certain. Further legal advice needs to be sought on this point.

The advantage of this option is the increase in the state's flexibility to respond to changes in workload and skill requirements; further, short-term hiring and lay-off problems are avoided. A clear accountability as to the cost of project delivery is established.

The disadvantages of this option depend on the degree to which contracting out is used to meet program delivery requirements. Caltrans should maintain in-house capabilities in critical professional disciplines, both to handle emergency situations, and to have a base of experience for evaluating contractor bids. There is also an adverse effect on existing state personnel unless some means can be found to implement state staffing reductions through attrition and/or moving of personnel to private sector firms.

Recommendations

Recommendation R15 also relates to this finding and recommendation.

R17: Seek a Constitutional Amendment to Remove Impediments to Contracting Out to Increase Flexibility, Efficiency, and Accountability

We recommend that the state constitution be amended to provide more flexibility to Caltrans in performing project delivery work and responding to changes in project, workload, and skill requirements throughout the department. With this flexibility, short-term hiring and lay-off problems are avoided. More importantly, however, clear accountability as to the cost of project delivery is established. This amendment, combined with the implementation of a management control system that focuses on improving cost and schedule performance over time, will encourage Caltrans to be competitive in the services it provides and to select strategies for delivering transportation projects that best fit the specific circumstances. This recommendation is a high-priority item for improving Caltrans' cost-effectiveness in project delivery and possibly the provision of other services such as maintenance and MIS support where private sector providers are widely available.

This recommendation was selected over the options to continue studying the benefits/adverse costs of contracting out and to develop a contracting-out experiment because of our emphasis on increasing Caltrans' flexibility to perform project delivery services. The recommendation is linked to the recommendations that establish individual and group rewards and punishments for performance, reduce contracting-out administration requirements, push partnering efforts, experiment with risk-taking and new project delivery approaches, and develop a strong support-cost control emphasis.

To assess any advantages of contracting out on resource requirements and management flexibilities, Caltrans management may need to establish a level of contracting out for a specified duration. This would provide internal units an opportunity to evaluate its effectiveness. After the specified duration, however, the level of contracting out should be determined on a competitive basis, bidding against internal units.

Finding H3: Growth of Managerial and Supervisory Work Classifications

Caltrans' data show that managers and supervisors appear to be increasing in numbers more quickly than rank and file employees. While the data reflect changes in classifications and job titles, the overall ratio of managers and supervisors to rank and file appears high by private sector standards.

Caltrans data show that the total departmental workforce grew about 30% in the 10-year period from 1983 to 1993 (see Figure II-7). The number of management personnel increased by 55%, and the number of all other employees increased by 25%. Within the management categories, the number of managers and exempts increased by 15% and supervisors by 60%. The rise in the number of supervisory employees appears to have been a steady annual trend during the decade measured. In good measure, this trend reflects the lack of a nonmanagerial career track for professional employees. As employees move to the top of the transportation engineering levels, their only promotional opportunities (and major salary advancement opportunities) lie in a supervisory position.

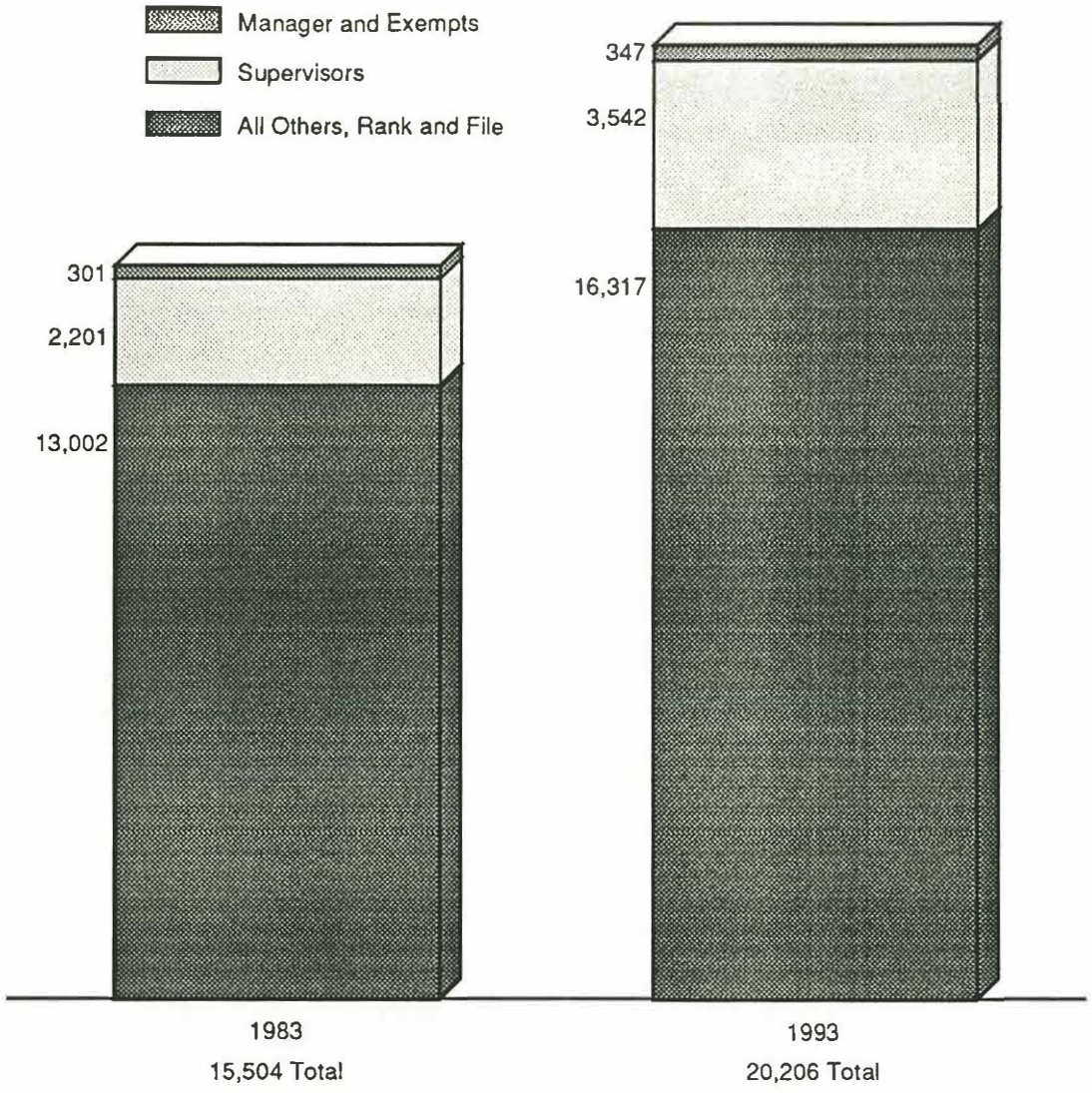


FIGURE II-7 CALTRANS WORKFORCE

The changes portrayed reduce the ratio of managers and supervisors (managers/supervisors) from approximately one manager/supervisor to five rank-and-file employees (in 1983) to approximately one manager/supervisor to four rank-and-file employees (in 1993). To quote from

a business study of corporate belt-tightening, "At lean companies, spans of control range up to one manager to 30 staff. A ratio of lower than 1:10 is a warning of arterial sclerosis." ("Enterprise," *Business Week*, 1993, p. 35). The ratios at Caltrans are both in the wrong range, and are moving in the wrong direction.

Options

H3.1: Establish Dual Managerial and Professional Tracks

A major part of the motivation for the promotions to the supervisory level is the desire to allow professionals to move into higher salary classifications. When these promotions occur, engineering professionals are moved into supervisory positions for the wrong reasons—again, a problem not unique to Caltrans.

Organizations have sought and found other ways to provide career and income paths to engineers—typically by establishing dual career tracks. In these systems, an engineer can advance in his or her discipline to higher technical levels without foregoing salary increases (or, at least, delaying a change to management). Caltrans could explore the benefits and costs of such a system with the Public Employees Relations Board as part of its overall restructuring of employee and management measurement, rewards, and disciplinary procedures.

The advantage of such a system is that senior professionals can continue in their areas of technical expertise longer than if they feel compelled to switch to a supervisory classification for higher pay. The disadvantage is that, sooner or later, technical track salaries will probably begin to lag managerial salaries in a professional's career.

Recommendations

R18: Expand Opportunities for Professional Advancement

The growth in the number of supervisory personnel and the high ratio of supervisor to rank and file suggest that alternative career paths need to be developed. We recommend that Caltrans' management review with the Public Employees Relation Board opportunities available within current statutes for creating new senior-level professional positions that do not require a supervisor's title or responsibilities, but that entail comparable (not necessarily identical) raises in salary. If little latitude for such a change exists in current legislation, then we recommend that a proposal for appropriate changes be taken to the governor and state legislature to expand current professional career path opportunities.

Finding H4: Appropriateness of Licensure Requirements for Tasks and Positions

Engineers have been the dominant figures in Caltrans since its early years. The importance of civil engineering expertise to road building, the first charter of Caltrans, has led to licensure as a professional engineer being a prerequisite for advancement. Despite evidence that backgrounds in right-of-way finance or general management are equally appropriate to lead functions and districts, Caltrans continues to be dominated by an engineering ethos and may be requiring licenses or professional degrees for positions that do not seem to require that level of expertise and pay. All district directors, for example, are now licensed engineers.

Human resource concerns underlie the issue of the engineering emphasis at Caltrans. Which posts require a licensed engineer has been a contentious question at Caltrans for years. Until recent times, all deputy directors in Sacramento and the districts were engineers. In 1980, Director Gianturco was apparently the first to appoint district directors who were not engineers—an innovation that barely outlasted her tenure of office. Currently, all district directors are licensed engineers. Director van Loben Sels, himself an engineer, however, has reversed the historical trend and has filled the bulk of his headquarters deputy directorates with nonengineers. The chief deputy director and chief engineer are now the only licensed engineers among key headquarters officers reporting directly to the director.

Determination of desired professional staff levels and assignments extends beyond the scope of this study; however, we gathered evidence in many functional areas about what one source called "engineering habits" at Caltrans—the tendency to request licensed engineers to perform management and administrative tasks for which licensure is clearly not a prerequisite, and the tendency to insist that licensure is a prerequisite for management of line Caltrans functions. We have encountered no compelling rationale to support these practices. We have also received reports of other professional ratings (such as planners) whose actual job requirements could be performed by lower level personnel because of the lack of professional input required in performing routinized administrative tasks. Further study would help identify positions and responsibilities that require professional credentials and/or licensure.

Options

H4.1: Reevaluate Tasks, Documents, and Files Requiring Review

One option would be for Caltrans to identify the tasks, documents, and files that require review by a licensed engineer. The desired effect would be to speed the flow of engineering work and to isolate tasks that other than licensed professional engineers can perform.

The advantage of this option is to expose the "base engineering load" of Caltrans. Pursuing the option could minimize unnecessary and expensive multiple levels of review. The disadvantage of this option is the risk that multiple levels of iteration are necessary to avoid mistakes and errors.

H4.2: Review Position Descriptions

Caltrans should review position descriptions and functions to ascertain the need for licensure or professional degree, particularly regarding the category of Professional Engineer (PE).

The advantages of this option are the potential cost savings and increase in flexibility if engineering credentials or other degrees are not required for positions in which they are currently needed. The disadvantages are the need for additional study and possible conflict with employee associations.

Recommendations

R19: Review Appropriateness of Licensure Requirements for Tasks and Organizational Positions

Professional Engineering licensure appears to be required for most senior professional positions at Caltrans covered by civil service classifications—if not required explicitly, then

required by reference to previous positions and experience. By statute, a licensed Professional Engineer must be involved in selected design and review activities; this requirement appropriately provides for necessary quality control and quality assurance (QC/QA). In the Caltrans culture, however, licensure appears far more pervasive than required by statute or by QC/QA requirements. Experience shows that the ratio of licensure in Caltrans professional staff is significantly higher than in comparable private firms. Because the state bears the cost of licensure, overlicensure of staff represents a diversion of staff time and training resources.

We recommend that task descriptions and position classifications be reviewed to determine how frequently PE licensure is actually required and whether alternative procedures for providing the PE review exist. Perhaps a single managerial-level (or senior supervisory-level) review would be appropriate and adequate. Licensure may remain a requirement for selected senior supervisory and managerial positions, but not for the present number. A Caltrans task force could undertake such a review, although we recognize that such has been done before. We suggest an outside consultant review (and possibly participate in) the process because of the deeply held convictions on this subject and strength of the PE culture at Caltrans.

As part of this review, we suggest that Caltrans benchmark its licensure requirements against those of other public- and private-sector businesses to determine whether they have similar requirements, or, if different, how they are able to operate without the high dependence on licensed professionals and managers. The findings from both assessments should be reported to the Agency Secretary, legislative transportation committees, and the CTC.

Finding H5: Difficulties Obtaining Specialists

The difficulty of obtaining specialists hinders Caltrans' ability to complete environmental review requirements on a timely basis. Environmental planning requirements seem to be increasing, with more specific skills required to respond to concerns of other agencies and special interest groups; Caltrans must have access to the skills needed to evaluate and design projects that will not require extensive redesign or added mitigation measures that delay project completion. Both the consultant hiring process and employee hiring processes are extremely time-consuming, making it difficult for Caltrans districts or headquarters to acquire persons with specific skills without delay of projects.

A staffing issue raised repeatedly during our interviews with district staff was a shortfall in staffing levels required to plan and design projects in a timely fashion with sensitivity to expanding environmental concerns. This problem has arisen partly because of increased demand for specialized staff at the same time that district offices are less well able to respond to the increase in staffing needs. Examples of requisite skills are biological specialists to assist in planning and environmental analysis relating to endangered species or wetlands, or archaeologists to deal with historical preservation issues.

Increase in demand for staff can be explained by a number of factors. First, the *Blueprint* and special measure programs have provided an injection of funds for new projects at the same time that Caltrans has been under pressure to accelerate project delivery. Exacerbating this situation is the increased complexity of project planning as a result of increasingly stringent and litigation-prone environmental review and permitting requirements. These trends have increased the demand for environmental specialties, as well as trained Caltrans staff in the areas of planning and engineering.

Constraints arise in several ways. First, some of the skills required are highly specialized; trained staff with selected specialties are in short supply. Yet, Caltrans cannot recruit and fill positions, but must instead go through the state civil service procedures, which require that Caltrans first try to locate specialists who are already employed by the state but need reassignment. Once the civil service determines that no employee already in the state system can fill the position, then Caltrans must adhere to a complex examination system. It may take more than 1 year to hire a specialist under these procedures.

Second, some work can only be performed seasonally. Examples are research work on wetlands impacts, impacts on migratory animals, or investigations in areas that are inaccessible during winter. Therefore, although there may not be a year-round shortage of certain specialists, there can be a severe shortfall during certain months.

Options

H5.1: Conduct a Skills Inventory

In this option, Caltrans would conduct a skills inventory with other state agencies to maintain a roster of state personnel with required skills.

The primary advantage of having a list of state skills would be the ability to find appropriate skills required for a problem and to use the person without an extensive, time-consuming selection process. The cost of this approach would be low because Caltrans would only pay for the specific time needed at state employee rates, which might not include overhead burden.

The main disadvantage of this option is that a roster would need to be updated frequently to deal with personnel changes. The biggest difficulty would be that most state agencies, particularly those funded through the General Fund, do not have excess staff and would be unwilling to loan specialists to Caltrans. Another disadvantage of this approach is that environmental specialists in natural resource departments might find it difficult to work in a situation requiring a focus on development mitigation.

H5.2: Simplify Recruiting and Hiring (District Level)

In this option, Caltrans would simplify the employee recruiting and hiring process at the district level to facilitate the process of obtaining specialists. The extent to which traditional civil service rules are relaxed depends on the other enhancements with which this is paired.

With the exception of some specialist skills only represented at the headquarters Environmental Division, most work on project and environmental analysis occurs at the district level. The advantage of this option is that it would permit the current practice of decentralizing environmental document preparation to the district level to continue, allowing each district to determine its staff needs. Priorities would be set and controlled by district managers.

The primary disadvantage is that it would require modification to the current state civil service hiring process to allow districts to hire more rapidly when deemed necessary. Hiring more staff would also increase overhead expenditures, resulting in the need for additional office space and support staff. Use of specialized staff expertise at the district level may result in differing approaches and levels of mitigation, inadvertently creating unintended precedents. Moreover, state hiring practices often require selection of entry-level staff who may not have the correct level of expertise.

H5.3: Simplify Recruiting and Hiring (Headquarters)

In this option, Caltrans would simplify the employee recruiting and hiring process at headquarters or at a regional multidistrict level. As with the preceding option, the extent to which traditional civil service rules are relaxed depends on the other enhancements with which this is paired.

The advantages of this option are that staff specialist disciplines at the regional or state level would encourage a greater degree of specialized expertise in required areas and help maintain a consistent Caltrans' approach to design and mitigation. The number of specialists may be reduced if hired at the centralized or multidistrict level. A multidistrict (southern, central, northern) consolidation of specialist skills may provide a good compromise of site and project availability with less potential overstaffing than could result from individual district staffing.

Increasing Caltrans staff, however, would generate additional overhead requirements. Consolidated multidistrict staff could create conflicts between priorities of nearby districts, requiring headquarters' involvement in project priorities if they cannot be resolved by interdistrict cooperation. State hiring practices often require selection of entry-level staff who may not have the correct level of expertise.

H5.4: Facilitate Contracting Out

In this option, Caltrans would develop alternative procedures to facilitate the contracting-out process for selected specialist skills, reducing bureaucratic contracting regulations. The possibility of creating temporary staff positions could be included.

The advantages are that it would allow districts to select and retain specialist consultants in a more timely manner, using bid and selection processes routinely used by other public agencies throughout the state. This option would provide the greatest flexibility in retaining specialists with the needed skills and needed level of experience.

The disadvantage of this option is that it could increase costs if consultants are overused in areas for which it would be more cost-efficient to hire full-time staff. Consultants are often not as familiar with Caltrans and FHwA regulations and procedures, requiring more oversight of their work.

Recommendations

R20: Identify Needs and Simplify Procedures for Obtaining Specialists

At times, the difficulty of Caltrans obtaining specialists delays project delivery. This problem occurs most frequently during the environmental process, when the inability to mobilize biologists or archaeologists in a timely manner can result in major delays. An example may be a seasonal species assessment, where a 3-month delay can delay a project by a year until appropriate assessments can be conducted. As requirements to respond to legislation such as federal and state protection for endangered species, historic preservation, or Clean Air Act amendments increase, so too does the need for technical specialists who may not be Caltrans career employees.

SRI recommends that Caltrans develop alternative procedures to facilitate the contracting-out process for selected special skills, reducing existing bureaucratic contracting regulations.

The possibility of creating temporary non-career staff positions could be included. While reducing the complexity of the contracting-out procedure, Caltrans should identify and prescreen a pool of potential specialists who are familiar with Caltrans and FHwA regulations and procedures so that nonproductive training and oversight are not required. A skills inventory of state environmental specialists might also help in this regard without having to go outside state employment.

Finding H6: Filling Mid- and Senior-Level Vacancies

Most Caltrans executive managers have reached their late 50s or early 60s. Many have already reached the maximum value of their retirement plans. Their retirement (particularly if accelerated by an early retirement offer) will raise questions about the adequacy of the preparation of those poised to succeed. Managers now in their 40s are about to move to executive positions, raising questions about their experience and training.

Staffing issues should be understood in the context of a demographic skew in the Caltrans workforce. Caltrans rapidly scaled up its activities in the 1950s and 1960s, which generated promotions for the cohort of employees who joined in those decades. Downsizing in the mid-1970s left an especially large group of individuals in senior positions, typically in their 50s and 60s, who are supported by deputies and assistants generally 15 years or more their junior. Caltrans will, therefore, shortly face a management succession issue:

- An entire cohort of senior managers is likely to retire within a short period. If the state enacts an early retirement scheme of the sort introduced in the last legislative sessions, retirement is apt to affect the bulk of Caltrans' most senior managers.
- Successors now in their late 30s and early 40s are the most likely candidates to fill Caltrans' most senior positions. Their accession to the most senior career grades is likely to dramatically increase demands on their managerial skills and expertise.

An alternative to promotion from within is to increase the involvement by non-Caltrans employees in filling mid- and senior-level vacancies. Opportunities for moves between Caltrans' and the transportation departments of other states, local transportation agencies, transit districts, or public works departments would be beneficial in terms of broadening staff perspectives. Any active effort to obtain outside candidates would likely require revisions to current civil service practices.

Options

H6.1: Identify and Provide Management Training and Management Development Programs

To assure that the next generation of managers has the requisite skills, Caltrans should review the managerial succession that can be expected over the next 3 to 5 years. Several scenarios are possible, with the greatest unknown being the terms of an early retirement program

that may be offered to state employees. Based on this review, the training needs of the emerging generation of senior managers can be identified.

The advantage of such a review is that it will permit the productive use of existing lead time to provide necessary training and, as a result, reduce subsequent problems arising from management promotions. The disadvantage of such a review occurs if the current training program is adequate to provide the necessary managerial skills under alternative scenarios. In such a case, the review has added no value.

H6.2: Facilitate External Hires

Individuals with appropriate managerial expertise from other states' transportation departments, federal and regional agencies, and the private sector could bring new ideas and approaches to cost-effective management of people and projects. Yet, qualified personnel external to the state civil service are limited in obtaining managerial appointments within Caltrans (aside from governor- and director-exempt positions) because of the civil service selection process.

A substantial relaxation of civil service rules is required to facilitate recruiting and screening of qualified persons outside the Caltrans organization. For the change to occur, an enormous array of civil service rules that apply to employee eligibility lists, past experience, ranking of examination scores, ordering of qualified candidates, veteran preference ratings, and the like would need to be reexamined. While selected relaxation of some criteria might be readily obtainable (such as consideration of appropriateness of prior experience), any further changes will need to be examined in detail for their wide effect on the state's civil service system.

Recommendations

Recommendation R16 also applies to this finding and recommendation.

R21: Provide Training and Development Programs and Increase the Flexibility to Hire Externally to Fill Mid- and Senior-Level Vacancies

A high proportion of Caltrans executive managers are nearing retirement age; as a result of reductions of staffing during the 1970s, the next generation of leadership tends to be second-level managers in their 30s or 40s. We recommend that Caltrans identify the emerging generation of senior managers and provide training opportunities to allow them to become effective managers without the depth of experience their predecessors had. Much of this staff training can be accomplished internally in Caltrans' training academies, but some training may require outside expertise or perhaps temporary assignments to agencies outside state government.

Currently, first preference for promotional opportunities is given to Caltrans employees, with second preference given to other state government employees. External candidates can only be selected after determining that no Caltrans or existing state government employee is qualified for the position. SRI recommends that impediments to selecting higher level staff from external sources be reduced. In fact, greater movement between Caltrans, other transportation agencies, and private industry at higher management levels would benefit the efficient accomplishment of Caltrans' mission.

Finding H7: Competitiveness of Caltrans Salaries

Our review of salary data indicates that Caltrans' salaries are competitive at the entry level, but decline in competitiveness as seniority increases.

Caltrans employees are compensated on the same pay scale as all other employees of the State of California. Compensation levels are outside the scope of our study, except as regards two observations related to staffing and management issues:

- Effects of pay on recruitment and retention
- Effects of pay on job mobility.

Recruitment and Retention. Pay makes recruiting junior engineers easy and retaining experienced engineers harder. Because engineers are critical to the functioning of Caltrans in nearly every description, we undertook limited investigations about attracting them to and retaining them in employment.

Numerous sources told us that Caltrans offers competitive salaries for new civil engineering graduates in comparison with private sector employers. The disparity between public and private sector reverses after 5 to 7 years of employment; that is, Caltrans offers salaries that are not competitive with those in other public sector and private sector firms for experienced engineers. The discrepancy becomes steeply progressive at senior professional and management levels. PECG survey data suggest that relative to other public bodies, Caltrans' senior and supervising engineer salaries lag by 15%-20%, while relative to private sector firms, these same salaries lag 50% or more. Information received from the American Association of State Highway and Transportation Officials (AASHTO) indicates that Caltrans employees are generally in the top quarter, but are not the highest paid professionals. Our interview and documentation sources rightly note that compensation is only one part of an employment package that includes benefits and noncompensation elements, such as perceived stability of employment, training, work satisfaction, and retirement/health/vacation benefits, yet their salary discrepancies are hard to ignore.

Roughly 350 career executives, principal engineers, administrative principals, landscape architects, right-of-way principals, and managers plus about 16 political appointees or "exempt" employees constitute the management cadre of Caltrans. Caltrans executive managers receive 10% or less of the compensation of their counterparts at Fortune 100 industrial firms listed on major stock exchanges and an estimated 15%-25% of their counterparts at private sector engineering firms.

Some sources suggest that the pay increases granted to state employees in recent years have fallen below increases in the Consumer Price Index or other indicators of price inflation; that is, state employees may have suffered real dollar losses in income. We have not attempted to validate this view. A compensation study that assesses the importance of pay and benefits to attract and retain high-quality engineers and executives appears to be worthwhile.

Proponents of change at Caltrans have proposed to tie steep monetary incentives for senior executives to the attainment of performance objectives. The potential to increase outputs from the addition of substantial incentive pay needs to be evaluated.

Pay and Mobility. Until the early 1980s, Caltrans employees often rotated through a period in one or more district offices and through periods in Sacramento. One of the striking observations about senior Caltrans management is the degree to which senior managers (district directors and direct reports to the director) have a lifetime of experience in the organization. With few exceptions, senior managers have 20 to 30 years' experience at Caltrans.

Most of these Caltrans managers have made numerous professional moves, including changes in location, during their careers. The experiences gained in one part of the organization, and the ability to see the how's and why's of various district and headquarters perspectives, has been part of their professional growth. This mobility appears to be on the decline for at least two reasons. First, the rising price differential between urban and rural housing costs has made it difficult for any staff living outside an urban center to contemplate moving to such a location without a noticeable diminution in standard of housing (or as some interviewees expressed it, overall quality of life). Conversely, urban residents face tax problems if they move to the (generally lower cost) offices outside the major urban centers. A second reason for the decline appears to be the growth of two-income households. A Caltrans employee is less likely to be the sole (or even the major) wage earner than in past years. With two-income households, decisions on locational change frequently present major problems as to family income.

Several examples illustrate the impact described. No manager in District 7 (Los Angeles) now has experience working in Sacramento. Conversely, managers based in Sacramento who seek district appointments typically do so in District 3 (Marysville) or District 4 (Oakland)—work assignments that can be accomplished by commuting from Sacramento rather than leaving comfortable Sacramento housing to less desirable housing in the metropolitan districts.

Caltrans may need to investigate metropolitan premiums or allowances for transfers to support long-term career paths incorporating diverse responsibilities and experiences.

Options

H7.1: Review Salary Classifications

Caltrans management should review with the DPA its flexibility in maintaining salaries closer to those of other public agencies for similar responsibilities, skills, and experience. If possible and appropriate, then changes should be introduced into salary schedules.

The advantage of this option is that it will help Caltrans to remain competitive relative to other public agencies in retaining qualified staff. The disadvantages are that it would increase the cost of professional labor, and the remaining differential between public and private sector employment may continue to draw talented professionals into private sector positions; thus, the overall effect of salary upgrading could turn out to be negligible.

H7.2: Seek Opportunities for Nonmonetary Incentives

An alternative to salary upgrades could be the provision of nonmonetary incentives. These might include some form of advanced education benefits. The advantage of this option is that it would narrow the gap with other public agency compensation packages. The disadvantages are the same as those for the preceding option.

H7.3: Vary Remuneration by Location

Living allowance supplements and pay differentials could be reviewed to determine how they can be more effectively employed to provide for mobility within Caltrans staff. If changes in civil service rules will be required, then these can be identified and the cost of possible changes estimated. The advantage of this review would be to determine whether Caltrans is using the resources available to alleviate the growing problem, and to identify possible other resources that might be used. The disadvantage is that the problem may be so pervasive to state government (not to mention society) that little relief can be obtained.

This review should also consider procedures that might establish high mobility goals early in an employee's career (soon after entry from college), with declining moves subsequently. Such timing may help to mitigate family and dual-income effects of periodic relocation.

Recommendations

Recommendations R15, R17, and R21 also relate to this first recommendation.

R22: Review Salary Classifications

Currently Caltrans' salaries are competitive with the private sector at entry levels, but seriously decline in competitiveness as seniority increases. To remain competitive relative to other public agencies and with the private sector in retaining qualified staff, Caltrans management should review with the DPA its flexibility in maintaining competitive salaries. If possible and appropriate, salary schedules should then be changed.

R23: Assess Potential to Vary Remuneration by Location

Most of the reasons for the declining mobility described are beyond Caltrans' control. If, however, Caltrans is committed to providing opportunities for broadening managerial experience, then we recommend that it initiate an experimental approach to increasing cost-of-living and/or salary differentials to determine whether it will encourage selected staff to move when appropriate. The experiment might screen for qualified staff in specified skill and seniority categories, and then provide supplemental stipends to a small number of individuals (families) for a 3-year duration at a new location. Alternately, an attitude survey could seek to assess what thresholds of support would be needed to provide sufficient incentive, and the costs reviewed in light of the anticipated benefits.

Finding H8: Inadequate Response to Affirmative Action Complaints

Caltrans has made notable strides in affirmative action compliance in some areas but lags in others. Internal task forces are currently addressing those areas that have lagged. The department's apparent inability to handle discrimination complaints in a timely fashion continues to be a major cause for criticism.

Affirmative action activities at Caltrans cover a number of areas including hiring, retention, and promotion, as well as discrimination grievances. This section looks at accomplishments as well as unresolved issues.

State government establishes many of the policies and procedures that determine the environment within which Caltrans operates. In addition to the affirmative action office at headquarters, each district office has affirmative action officers who are concerned with affirmative action policies as well as discrimination grievances. Further, collective bargaining units (external to Caltrans) may be temporarily involved in discrimination complaints before they are referred to the affirmative action office in Caltrans or other state agencies such as the State Commission on Fair Employment and Housing or the State Personnel Board. The affirmative action program has four main objectives:

- Have a workforce that fully represents the working population of the state
- Meet vertical parity in the department's workforce for all members of affirmative action groups (i.e., management should also reflect the working population)
- Provide a work environment free of discrimination
- Assure equality in the services the department provides (this primarily refers to appropriate use of bilingual staff).

Affirmative Action Accomplishments. One way to measure the success of the affirmative action program at Caltrans is to compare the demographic composition of the total employees, new hires, and promotions for the fiscal year July 1, 1992 to June 30, 1993 with the characteristics of the statewide labor force. Caltrans reports this information by gender within each minority group in a table entitled, "Department Total, Affirmative Action Report." Statewide labor force participation (LFP) for the same groups is also included in the table. The statewide LFP provides a benchmark of what the composition of the Caltrans labor force should be if all groups participated proportionately.[1] Results for the most recent fiscal year are as follows:

- *Total employees within Caltrans (19,502)*—The percentage of total employees represented by Asians, Blacks, and Filipinos is the same or greater than their LFP percentages. In other words, the percentage of Caltrans employees falling into these three groups reflect their distribution in California's labor force. On the other hand, Hispanics and women are employed at rates below their respective LFP percentages.
- *Total hires for the period covered (1,128)*—Of the employees hired during FY1992/1993, females were considerably below their LFP rate, but are being hired at a rate that is somewhat greater than their current representation within the Caltrans labor force. If this trend were to continue, in the long run the percentage of female employees would increase. Black, Filipino, and Asian employees were hired at the same or slightly higher rates than their LFP rates, and Hispanic women were hired at a lower rate.
- *Total promotions for the period covered (964)*—A greater percentage of females and Hispanics were promoted (34.3% of all employees promoted were female and 18.5% were Hispanic) than their percentage participation

[1]The LFP numbers used in this table ignore geographic area within the state and occupation.

within the Caltrans labor force (24.8% and 14.1% respectively). Rates of promotion for other groups were comparable to their percentage representation within Caltrans.

Based on these outcomes, Caltrans' affirmative action office proposed both short-term and long-run solutions (referred to as Tier I and Tier II). Tier I proposes a higher hiring goal for females, and the Tier II "Grows Its Own" Employees approach focuses on training and assisting the development of engineers and skilled workers to increase the labor pool of qualified minority and female workers from within Caltrans.

Affirmative Action Issues. The two major affirmative action issues identified during our evaluation include the establishment of goals and the handling of discrimination complaints.

- *Hiring goals*—The issue of what should be used for affirmative action goals was discussed in the recently released *Affirmative Action Program Audit*, prepared and released by Caltrans in July 1993. In that document, the Office of Affirmative Action argued that the use of statewide LFP percentages did not reflect the actual composition of the labor force within specific occupations for different geographic areas. Instead, the LFP number should be specified by area (or district office) and by occupation. For example, although females may comprise 44% of the statewide labor force, they constitute 8.7% of civil engineers in District 7. Consequently, 8.7% should be the number used for affirmative action goals.

  Some within Caltrans opposed this suggestion and it has not yet been adopted. Affirmative action advisory committee members viewed this suggestion as an attempt to dismantle the affirmative action program. At this point a compromise plan is being developed.

- *Discrimination complaints*—According to the *Affirmative Action Program Audit*, Caltrans does not process discrimination complaint cases on a timely basis. The report suggests that the department's discrimination complaint process be improved to "reduce the negative effects on the productivity, morale, and work environment of both complainant and defendant." Another concern voiced by representatives of two of the bargaining units (California State Employees Association and the International Union of Operating Engineers) was the way in which complaints are handled at Caltrans. For example, they asserted that Caltrans tried to protect management by shifting responsibility to a lower level staff member. These bargaining units often do not refer discrimination complaints directly to the affirmative action office at Caltrans, and instead favor other state agencies, such as the state Equal Employment Office (EEO) or the State Commission of Fair Employment and Housing.

  On a more positive side, Caltrans put together a sexual harassment training course, and by December 1993 all staff will have received this training. Because of the increased openness and awareness, the number of sexual harassment grievances filed has increased.

Options

H8.1: Increase Staff to Process Complaints

One option is to increase Caltrans staff to process discrimination complaints. This option provides Caltrans with the advantage of being able to research, review, and process more discrimination complaints, which will speed up the process. The disadvantage is that increasing the number of staff who investigate discrimination complaints may only be possible by reallocating staff within Caltrans. At present, the budget is tight, and increasing the total number of staff is difficult.

H8.2: Refer More Complaints

A second option is to refer more complaints to other state agencies to review. An advantage is that complaints will be processed more quickly, without the need to augment Caltrans staff. In addition, this option would reduce Caltrans' involvement in investigating discrimination complaints. Because more investigation will be external to Caltrans, however, some inefficiencies may be introduced (e.g., more time spent in data collection). Caltrans may also perceive some loss of authority.

H8.3: Improve Procedures

A third option is to improve procedures and examine how other state departments process discrimination complaints. Such a change in procedures may reduce the need to increase staff while still decreasing processing time of complaints, although there may be other factors, not procedures per se, which make the review process slow; improved procedures may make no difference.

Recommendations

R24: Improve Procedures for Processing Affirmative Action Complaints

One of the principal criticisms voiced in the 1993 Affirmative Action Program Audit was the amount of time that complainants wait before the investigation of their charges is completed. In our evaluation we could not determine whether this problem stems from inappropriate staffing levels, inadequate procedures, or the low priority Caltrans management assigns affirmative action complaints. If inadequate procedures are the root cause, then Caltrans should modify its procedures, possibly using other state departments as a model. The Commission on Fair Housing and Employment is an example of a state office viewed by Caltrans employee associations as having a better track record in processing affirmative action complaints.

Finding H9: DBE Certification Process Problems

Although the Disadvantaged Business Enterprise (DBE) certification process has improved, legislators still receive complaints from their constituents regarding the certification process. In addition, some DBE firms feel that they lose job opportunities while their applications for certification are pending.

Certification Procedures. DBEs are defined as firms that are owned by individuals who are minorities (MBE), women (WBE), or disabled veterans (DVBE). More than 51% of the firm must be owned by a minority or woman in order for the firm to be classified as a DBE. Federal requirements stipulate that no less than 10% of contract dollars be allocated to DBEs.[2] States are permitted to set their own goals in excess of the federal minimum, however. In fact, for those contracts that fall under federal guidelines (projects that receive some or all federal funding), Caltrans has established a 20% DBE goal. For those projects that are wholly state-funded, DBE requirements are 23% (15% MBE, 5% WBE, and 3% DVBE).

These requirements do not apply for each contract. The state and federal goals are to be met on a statewide basis; some contractual requirements will exceed these goals, and some will be less. The requirements for a contract are determined by the following:

- *Location of a project.* Contracts advertised for remote areas in northern California may have only 4% or 5% DBE goals because there are not many qualified firms in that area. In metropolitan areas, some contracts may have requirements of up to 40%.
- *Type of project.* Projects where there are subcontractible areas will have higher requirements (e.g., paving, trucking, and traffic control) than those that do not (e.g., bridge and demolition projects).

Caltrans certifies MBEs and WBEs while the State Department of General Services (DGS) certifies DVBEs. Legislators receive frequent complaints from their constituents regarding the certification process. Caltrans' Office of Legislative and Local Governmental Affairs receives approximately eight complaints each month.

The process has been accelerated within the past year. Formerly, the certification process could take up to 1 year. During that year, an applicant might not hear from Caltrans, and sometimes Caltrans would contact the applicant to request more information. At present, it takes between 3 to 6 months to be certified. The department's goal is to shorten the process to 3 months, but staff indicated that they do not have sufficient personnel to achieve this goal. The Office of Civil Rights (of Caltrans) stated that it cannot complete the process in less than 3 months because of documentation required for certification under federal regulations. Federal regulations are important, since almost 80% of the projects contracted out receive some or all of their funds from the federal government.

The DBE business community is upset that the certification process takes so long. Firms need to be fully certified before they can be considered for Caltrans work. These firms feel that they are losing job opportunities while their applications for certification are pending.

Options

H9.1: Require Less Documentation

One option is to require less documentation for certification. The advantage of this option is that simplifying administrative details could reduce processing time. The disadvantage is that it could result in ineligible firms being certified as eligible.

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[2]The definition of DBE for federal contract purposes does not include disabled veterans.

H9.2: Recertify Less Frequently

Another option is to recertify firms less frequently. The advantage is that if Caltrans staff were not required to recertify DBEs on an annual basis, then more staff time could be available to process new applications. However, this option may allow firms that are no longer eligible to be incorrectly classified as DBEs and thus continue to participate in contract competition.

H9.3: Increase Staff Working on DBE Certifications

A third option is to increase the number of staff working on DBE certifications. This option provides Caltrans with the advantage of continuing the tradition of a rigorous certification process, while speeding up the time it requires to complete certification. Maintaining accurate certifications is important for Caltrans since many other state agencies use Caltrans' certification in determining whether consultants can be considered to be DBE firms. However, increasing the number of staff who undertake DBE certification may only be possible by reallocating staff within Caltrans. At present, the budget is tight, and increasing the total number of staff seems unlikely.

Recommendations

R25: Reduce Documentation for DBE Certification

One of the causes for delays in the DBE certification process is the lengthy documentation that Caltrans requires from firms requesting to be certified. Examples of required documentation are: financial statements, proof of ethnicity, federal tax returns, resumes of principals, business license, and bank signature card. For corporations, Caltrans requires additional documentation, such as Articles of Incorporation, minutes of board meetings, copy of stock certificates, proof of stock purchase, and rental agreement for office space. Applications are not complete until all documentation has been received and determined to meet the standards for certification.

Some of the documentation requested is necessary to satisfy federal certification procedures. Firms working on projects receiving some or all federal funding must meet these requirements. This stipulation affects the majority of firms seeking certification since 80% of Caltrans projects fall into the federally assisted categories. Consequently, Caltrans is not at complete liberty to decide what documentation requirements to waive. Nevertheless, some items currently required are redundant and duplicate other items. These could be eliminated from the required documents list. Another possibility would be to allow applicants to select those items to be submitted from a range of options that Caltrans provides.

To safeguard against fraud, Caltrans could require spot checks of other documents no longer required. For example, if a bank signature card or rental agreement were required, Caltrans could ask for both from a random list of applicants to see whether having both documents would lead to a different certification decision. Furthermore, it might discourage fraud if applicants knew that spot checks were conducted.

R26: Recertify DBEs Every Two Years

Currently, Caltrans recertifies firms every year. Although some of a firm's characteristics change annually, such as its financial situation, tax returns, and number of employees, other aspects do not change each year. Examples of these include ethnicity and gender of principal

stockholders. Changing the recertification cycle to a biannual system would allow swifter processing for the new certifications and the recertifications.

An alternative to this recommendation would be to require a firm to undergo complete recertification every other year. In the years when a complete recertification was not required, a firm could be expected to provide a signed, notarized statement attesting that there had been no changes in the ownership of the firm that would affect its DBE status.

Finding H10: Meeting DBE Goals

Although the selection of consultants for Caltrans contracts has resulted in successfully meeting DBE goals, not all groups have equally benefited. African-American firms receive a very low percentage of DBE contract dollars for both design and construction projects.

Compliance with DBE Goals. Compliance with DBE goals can be defined in two ways. The first, and most common, is a comparison of numerical goals established by Caltrans with actual achievements. The second is whether the intent of the requirement is actually achieved—increasing the share of Caltrans contract work that is awarded to disadvantaged businesses.

Caltrans has met or exceeded federal goals for the last 4 years, and compliance with state goals is improving every year.[3] The most recent annual report submitted by Caltrans to the LAO for FY1991/1992 provides detailed information on DBE contracts awarded. Of the approximately $1.5 billion in transportation improvement contracts awarded, 20% of the funds were awarded to M/WBE firms, which serve primarily as subcontractors to prime consultants. Although Caltrans achieves overall compliance goals, the degree to which minority groups are participating varies widely. African-American firms, for example, received a very low percentage (6%) of the contract dollars awarded to M/WBE firms. Furthermore, while not excluded from being prime contractors, DBE firms are primarily being used as subcontractors.

Caltrans maintains a data base of certified firms so that staff can assist contractors with identifying eligible firms. Caltrans also funds three firms (one in the North, one in the South, and one for the Century Freeway project) to work with the certified firms as well as with the contractors who are seeking the services of DBEs. If a particular contractor does not meet its goals, Caltrans will look at the documented good faith efforts to comply with requirements. The outright rejection rates of prime contractors for either not complying with DBE requirements or not providing adequate documentation of their good faith efforts to comply with requirements have been very low over time.

In addition to compliance performance, one must examine whether DBE requirements are actually being met. Have requirements increased the number of DBE firms that bid on and win Caltrans contract work? The success of a DBE program should be assessed by the growth of qualified firms that compete for contracts. At times, DBE requirements may exceed the capacity of qualified DBEs. Although Caltrans believes it has established the capacity of a geographic area in terms of the number of DBE firms, in fact, the number of contractors is not equivalent to the capacity of an area. What counts is the financial and management capability of a firm, not just being in business.

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[3]The exception is DVBE requirements that have been in effect for only 2 years and that are not always met. Only a limited number of firms are certified in the DVBE category.

Impacts of DBE Goals on Project Delivery. The transition to DBE participation requirements initially was difficult for contractors. At first, they were confused; now, contractors know what is required—that is, either the contractor complies with the DBE requirements or documents its good faith efforts to comply.

The individuals contacted during this study feel that contractors have adapted to DBE requirements. In part, this adaptation may be explained by the orientation of the contractors who are interested in bidding on Caltrans projects. They have already learned that working with public entities requires compliance with contract clauses that are not required in private sector work. Therefore, contractors bidding on public sector projects may be more adaptable to special requirements that Caltrans mandates.

Options

H10.1: Undertake Research

Caltrans or the appropriate state agency could undertake research to determine the principal reasons for African-American firms not participating more fully in Caltrans' contract work. Possible reasons include the lack of firms performing services required by Caltrans, inadequate outreach to African-American firms, or the need for more training. A starting point for this research could be to talk to those private firms that serve as DBE clearinghouses for Caltrans' proposals, i.e., firms that provide the names of certified firms to prime contractors proposed on Caltrans' projects.

The advantage of expanding Caltrans' understanding of the reasons for there not being more African-American participation in contracts is critical to the formulation of new policies and procedures to address this issue. Some of the reasons for lack of participation may stem from causes external to Caltrans' policies, however. Consequently, research results may not generate workable options.

H10.2: Set Aside Funds for African-American Firms

Another option is to reserve a portion of the DBE funds specifically for African-American firms, until such time as their participation in Caltrans contracts is more proportional to population. The advantage of this option is that targeting contract dollars more specifically to African-American firms could increase their participation in Caltrans contract work. Its major disadvantage is that other firms (minority and nonminority) may feel this approach was not equitable. This approach may not enhance Caltrans' efficiency and effectiveness, which is the perspective used in this audit.

Recommendations

R27: Undertake Research to Identify the Causes of Low African-American-Owned Firm Participation in Caltrans' Work

Caltrans should undertake research to identify the major causes for the disproportionately low participation rates of African-American-owned firms in the department's contract work and impediments to increasing the share. These findings should provide a basis for determining what intervention by Caltrans is appropriate to address this deficiency.

MANAGEMENT INFORMATION SYSTEMS

Caltrans has been a significant user of computer systems since it purchased its first computer in 1956. Caltrans' DIS) calculates that spending on information services grew 50% from 1985 to 1992. The FY1992/1993 budget is $45,764,000, including approximately $14 million for processing services supplied by the Stephen P. Teale Data Center.

Projected DIS expenditures for the 1992-1995 period show double digit annual increases, with 1995-1996 spending forecast to rise to $56 million. Note that these expenditures do not include computer systems spending outside DIS, including the estimated $58 million startup cost of the engineering computer-aided design and drafting (CADD) system, the PRIME accounting system, and other equipment, software, and personnel costs incurred by Caltrans organizations other than DIS.

DIS spending increases have come from employee wage increases and spending for new equipment and services. DIS central and district staff levels are unchanged since 1980.

Caltrans has 370 full-time information services staff, including 200 DIS staff in Sacramento and 170 staff in 12 district processing centers around the state. An undetermined number of staff in other Caltrans organizations work full time to supply information services to others within their department.

Caltrans installed a number of on-line mainframe systems and 2,200 computer terminals, mostly between 1980 and 1986. The number of personal computers and specialized desktop workstations has exploded since 1986. Caltrans presently owns about 10,500 personal computers and 1,500 engineering workstations.

Recognizing the need to manage investments in information services technology within Caltrans, DIS developed a Strategic Directions Plan for 1992-1996 to guide the development of Caltrans' information resources and infrastructure. The plan was completed in late 1991 and covers developments in six areas, including:

- Computing environment and the technology infrastructure
- Computer application development environment and new technology to improve performance
- Corporate data base development to improve accessibility, data integrity, data sharing, and system responsiveness
- Partnerships between DIS and other Caltrans' organizations and outside entities to promote joint developments and technology transfer
- Emerging technologies and strategies that will enable Caltrans to apply new technologies effectively
- Resource management practices, including matching systems resources to needs, sourcing practices, information services funding, and aligning DIS resources with user requirements.

DIS has been following the Strategic Directions Plan since early 1992, reporting some success and some slippage from the original schedules. An updated plan was not available at the time SRI met with DIS, but we were advised that DIS intends to issue an updated plan by the end of 1993.

Caltrans faces a number of information systems related issues, including those described below.

Finding M1: Disconnected System Islands

> *The Caltrans application systems are primarily a series of independent system islands designed for and used within a single function. The system islands form barriers to cross-functional exchange of information, limit cooperation across organization boundaries, and reduce Caltrans' productivity. Data in one system are often duplicated in another system, and the duplicated data are often inconsistent between systems.*
>
> *DIS has a program under way to identify and eliminate redundant systems, systems whose functionality is duplicated in other systems. This program will simplify the Caltrans systems and should be pursued as long as the benefits outweigh the effort; however, the systems simplification program is unlikely to bridge the gap between the functional systems islands.*

The Caltrans application systems are primarily a series of independent system islands designed for and used within a single function. The Caltrans system islands set up barriers to cross-functional exchange of information, limit cooperation across organization boundaries, and reduce Caltrans' productivity. Flows of information created in one system often need to be manually transcribed into another system, a slow and labor-intensive process. To bridge some of these gaps, DIS has recently launched another program—the Data Warehouse—to link the systems islands to a new level of data bases.

Data are often duplicated between systems. DIS recently completed an analysis that identified a higher than expected degree of data redundancy within both the Human Resource and Project Management systems and a significant amount of data duplication between the two systems. Data duplication further impedes productivity, as the same data are entered by multiple users to update their respective systems. Further, duplicated data are often inconsistent between systems, with each system having a different degree of error of commission or omission and/or difference in timing.

A major impediment to data base integration is the fact that different Caltrans functions use different systems platforms. For example, project data for Accounting must be available on the PRIME computers, project data for the directorate are on IBM mainframes, and project data for project managers are often required on PCs or on DEC minicomputers.

DIS believes that many of the current systems are largely or entirely redundant. A program has been launched to identify and consolidate or eliminate these unneeded systems. As a first step toward that goal, DIS has established a data base documenting the functionality, use, and interdependencies of Caltrans systems.

Options

M1.1: Integrate Data Bases

Since 1986, DIS has been attempting to integrate the Caltrans systems around a limited set of data bases. That program is expected to take several more years to complete according to the 1991 Strategic Plan.

The data base integration approach adopted in 1986 offers several advantages, including:

- A rigorous rationalization of mainframe data bases
- Reduced data redundancy and inconsistency.

The data base integration approach also has several disadvantages, including:

- The approach is very labor intensive, and DIS has had difficulty freeing systems staff to work on data base integration.
- Progress is very slow and the payoff is relatively far in the future

In this option, these efforts would be continued.

M1.2: Expand the Data Warehouse Approach

Recognizing the difficulty of replacing all the Caltrans systems with new systems that use a single set of data bases, DIS has recently launched a program to link the systems islands to a new level of data bases. The Data Warehouse is the first example of the new data base level. The initial Data Warehouse contains general information about projects and project-related person-year and capital costs, and is automatically updated as the TRAMS, PCMS, and OE data bases are changed. DIS could expand this concept to all widely used data bases, thereby further reducing the urgency of the data base integration program.

The data warehouse approach offers several advantages, including:

- A single authoritative source for information
- Automatic updating
- Much quicker realization of results than the previous systems replacement strategy.

The data warehouse approach also has several disadvantages, including:

- Further duplication of data in the data base. All the data in the Data Warehouse are duplicated in other data bases.
- The need to change procedures and applications programs to make effective use of the Data Warehouse.
- The tendency to perpetuate the division of Caltrans systems into islands. The Data Warehouse depends on data created in the island systems and will complicate the issue when the time comes to change or replace the linked islands.

SRI supports the programs DIS has under way, including eliminating or consolidating redundant applications and the linked data bases exemplified by the Data Warehouse. SRI believes, however, that DIS has other options beyond expanding the data warehouse approach.

M1.3: Support Reengineering of Caltrans Business Processes

Business process reengineering represents a fresh start, a comprehensive restructuring of the organization, policies, procedures, and computer applications systems that together constitute a business process (e.g., project delivery, maintenance, administration). Given the problems identified in this audit and the large dollar impacts of project delivery inefficiencies, it is a logical candidate for reengineering as discussed in detail in the following section of this audit. (Alternately, maintenance processes could be a candidate because of their dollar impacts.)

Under this option, DIS would redesign its systems and procedures as part of the broader reengineering of a targeted business area (e.g., project delivery or maintenance) with the goal of developing new systems to fit the reengineered business process.

Recommendations

R28: Focus on Reengineering of Major Business Processes

The Caltrans application systems are primarily a series of independent system islands designed for and used within a single function. The system islands form barriers to cross-functional exchange of information, limit cooperation across organization boundaries, and reduce Caltrans' productivity. DIS has a program under way to identify and eliminate redundant systems—systems whose functionality is duplicated in other systems. This program will simplify Caltrans' systems and should be pursued as long as the benefits outweigh the effort; however, the systems simplification program will not bridge the gap between the functional systems islands.

Although we support the data warehouse approach, SRI recommends that DIS give first priority to assisting in an overall reengineering of major departmental business processes (such as project delivery). DIS would participate in the reengineering effort and eventually design new systems to fit the reengineered process. The arguments for redesign include:

- Redesigned processes will largely eliminate functional boundaries and systems islands.
- Redesign will provide procedures, a rare opportunity to simplify the entire process, including organization, policies, and systems.
- The redesigned process will almost certainly be more efficient and less costly to run and maintain.
- Redesign will eliminate the need to struggle with the current systems. The Data Warehouse-type link between data bases would be unnecessary.

Given the problems identified by this audit, the business processes that affect project delivery are logical first candidates for reengineering from scratch. SRI does not believe it is feasible or advisable to simultaneously redesign all Caltrans' processes. Therefore, we recommend that DIS continue the data warehouse-type efforts in support of business processes

that are not slated to be reengineered. Thus, if Caltrans elects to reengineer the project delivery process, DIS work to improve related systems and data bases independent of the integrated, overall reengineering effort should cease.

Finding M2: Slow Progress on Systems Integration

DIS began addressing the need to integrate Caltrans' systems processes in 1986 but has made little headway and continues to find progress difficult; however, DIS staff state they have "recently made excellent progress with a revised approach that focuses on shorter term redevelopment deliverables and a closer examination of existing systems and functions." The recently completed Data Warehouse Release 1.0 is cited as the first of the new generation of integrated data bases, but the Data Warehouse does not directly address the data redundancy issue and in fact creates a new data base with an additional level of redundancy.

DIS began addressing the need to integrate Caltrans' systems processes in 1986 but has made little headway and continues to find progress difficult. The approach chosen in 1986 posited a data base-driven strategy including:

- Five data bases would be implemented and used by all systems.
- Application systems were to be revised gradually to use the consolidated data bases, thus eliminating data duplication and improving inter-function information sharing and flows.

The 1991 Strategic Directions Plan calls for implementing the data bases; redesigning and integrating the processes stretch to 1996 and beyond. The targets include:

- Human Resources and Project Management data bases by 1996
- Transition to the Roadway Network data base to begin in 1994 and be complete in 1996
- Implementation of the Maintenance data base to begin in 1996.

The rapid pace of technology change has repeatedly complicated the transition to shared data bases. For example, the widespread adoption of personal computers and specialized network systems such as CADD and the Accounting PRIME system have raised the need for multiple software interfaces between users and the systems and data bases. DIS has also found it difficult to maintain momentum on a multiyear program that must constantly compete for scarce systems development resources, that requires a large and uncertain amount of resource, and that promises only long-term payback.

DIS staff state they have "recently made excellent progress with a revised approach that focuses on shorter term redevelopment deliverables and a closer examination of existing systems and functions." The recently completed Data Warehouse Release 1.0 is cited as the first of the new generation of integrated data bases. The Data Warehouse integrates project-related information on a single file to enable project managers to access and use project data to manage their projects. Data Warehouse project data are automatically updated as other data bases are changed, thus eliminating the need for a separate update and reducing or eliminating the chance for data inconsistency between data bases. Data Warehouse, however, does not directly address

the data redundancy issue and in fact creates a new data base with an additional level of redundancy.

Options

M2.1: Abandon the Comprehensive Systems Integration Approach

Caltrans and DIS could abandon the comprehensive systems integration approach adopted in 1986 and carried forward in the 1991 Strategic Directions documents.

Abandoning the systems integration program has several advantages, including:

- DIS staff will be freed to focus on the recommended business process redesign programs and to expand the data warehouse concept
- The alternate data warehouse approach yields improvements much more quickly
- Business process redesign has the potential to yield much larger and longer lasting benefit than either the current system integration program or the data warehouse approach.

Abandoning the comprehensive systems integration program has disadvantages, including:

- The existing systems, with all their shortcomings, will survive intact until they are replaced as part of a business process redesign program, which may be some years in the future.

M2.2: Limit the Comprehensive Systems Integration Approach

DIS could limit the comprehensive systems integration approach to those sections of the Caltrans systems inventory that will not be replaced because of a business process redesign and that do not lend themselves to a data warehouse remedy.

Limiting the systems integration program has several advantages, including:

- DIS staff will be freed to focus on the recommended business process redesign programs and to expand the data warehouse concept.
- The advantages of the business process redesign and data warehouse approach can be realized more quickly.

Abandoning the comprehensive systems integration program has no known disadvantages.

Recommendations

R29: Abandon the Comprehensive Systems Integration Approach

We believe the situation has changed sufficiently since 1986 to negate the comprehensive data base integration approach. The adoption of multiple computer platforms, mainframes, minicomputers, workstations, and PCs that has occurred since 1986 has compromised the 1986 strategy, which assumed a mainframe solution. The DIS Data Warehouse is a relatively good short-term replacement for the data base integration program, and SRI believes the business

process redesign option described in Finding M1 is a better long-term system integration alternative for Caltrans.

Finding M3: Dated Systems Development Practices

DIS needs to modernize its applications systems development practices. DIS recognizes the need to invest in CASE hardware and software tools together with staff training to use the new tools. The 1991 Strategic Directions plan included a program to introduce more modern systems development approaches in DIS. The recently introduced Data Warehouse system was developed with CASE tools and employs a new-to-DIS relational data base manager (DB2), a standard graphical interface to users, and a user-friendly Structured Query Language to enable users to generate ad hoc inquiries.

DIS needs to modernize its applications systems development practices. DIS systems development practices have not been changed to take advantage of the computer-aided systems engineering (CASE) tools and techniques that have been widely adopted in the last 5 years or so. Most DIS systems development personnel continue to use the methods learned years ago, before the advent of CASE tools.

DIS recognizes the need to invest in CASE hardware and software tools together with staff training to use the new tools. The 1991 plan included a program to introduce more modern systems development approaches in DIS.

DIS believes Caltrans is the first state agency to implement a system developed with CASE tools. CASE tools were used successfully to develop the recently introduced Data Warehouse and California Certification systems. The Data Warehouse system also employs a new-to-DIS relational data base manager (DB2), a standard graphical interface to users, and a user-friendly Structured Query Language to enable users to generate ad hoc inquiries. As a result, DIS management state they have made "significant progress in training a core group of DIS staff in new systems development practices and CASE tools." The next logical step will be to institutionalize that knowledge, including adopting a new standard systems development methodology, training DIS staff to use the new methods, and providing encouragement and assistance to DIS staff while they are learning to apply the new methods.

Options

M3.1: Install a New Systems Development Environment

Given the positive experience with new mainframe systems development practices gained in the Data Warehouse project, DIS could decide, articulate, and implement a new working environment for DIS mainframe systems development personnel. DIS will need to invest in hardware, software, and training to implement the new systems development practices. Advantages are likely to include:

- Better and more complete systems design, fewer occasions when a development program needs to be restarted
- Better systems maintainability
- Lower overall system life-cycle costs.

Disadvantages of moving to a new mainframe systems development environment at this time include:

- The need for additional staff to free systems development employees to learn to function in the new working environment
- Additional funds for hardware, software, and staff
- The uncertain future of mainframe systems at Caltrans. Most recent new system developments have focused on microprocessor applications.

M3.2: Develop Expertise in New Technology

The DIS systems development improvement strategy is focused on mainframe systems, the traditional preserve of DIS personnel. An increasing portion of the systems work in Caltrans, however, is likely to involve the use of new technology such as expert systems and imaging. Caltrans has typically relied on subcontractors to implement new systems that use new-to-DIS technology. Since most new systems have been directed away from mainframes, SRI believes DIS will need to develop competence in the new technologies as they are adopted. Because of the large number and diverse nature of the new technologies, DIS could develop a limited number of specialists in each important new technology but likely could not cover all the technologies that might be in use nor cover any one technology in great depth.

The advantages of this approach include:

- An enhanced ability to steer the application of new technology in the long-term best interests of Caltrans and fewer risks that investments in new technology will become one-off solutions that quickly become obsolete
- Enhanced systems expertise within Caltrans and thus less need to constantly look outside for specialists to deploy new technology.

The potential disadvantages of specialization within DIS systems development staff by technology include:

- Erosion of the number of DIS staff in the mainframe systems development pool, potentially inhibiting the development or enhancement of existing mainframe systems
- Potential inhibition of new technology deployment due to the limited numbers of DIS staff and the corresponding limit on DIS's ability to support new technology
- The risk of investing DIS staff time and training on what may prove to be single-purpose technologies, with no continuing use.

Recommendations

R30: Assess the Future Need for Mainframe System Development

The trend toward microprocessors and specialized information systems technology brings into question the future of mainframe systems at Caltrans. Caltrans could clearly benefit from a new mainframe systems development environment if a substantial number of new mainframe

system development activities are in the offing, but that is uncertain in light of recent trends. SRI therefore recommends that DIS and Caltrans closely examine the future role of mainframe systems at Caltrans before investing further in mainframe systems infrastructure such as new development tools.

R31: Upgrade DIS Systems Development Practices

The recently introduced data warehouse system was developed with CASE tools and employs a new-to-DIS relational data base manger (DB2), a standard graphical interface to users, and a user-friendly Structured Query Language to enable users to generate ad hoc inquiries. The 1991 Strategic Directions plan included a program to introduce more modern systems development approaches, such as were used in the data warehouse development, and invest in CASE hardware and software tools together with staff training to use the new tools. However, DIS has not yet formally adopted a new mainframe systems development environment, including tools and standard practices, and DIS staff training in the new methods has been limited to a small cadre.

Consequently, we recommend that Caltrans decide, articulate, and implement a new working environment for DIS mainframe systems development personnel after first satisfying itself that mainframe systems have a future at Caltrans (see the related recommendation above). DIS will need to invest in hardware, software, and training to implement the new systems development practices. The benefits of using the latest generation of system development approaches will be better and more complete systems design, fewer occasions when a development program needs to be restarted, better systems maintainability, and lower overall system life-cycle costs.

Finding M4: Out-of-date Staff Skills

> *DIS will need to invest in staff retraining to enable Caltrans to take full advantage of new technologies. DIS development staff's knowledge and skills are attuned to COBOL programs in a mainframe environment, yet the current technological trend is unmistakably away from the current skill sets of DIS staff. The major new systems that have been developed in the past 5 or 6 years have invariably used a quite different technology set, including specialized minicomputers or microcomputers rather than mainframes, single-purpose data networks, and specialized data bases. DIS staff training in the new methods has been limited to a small cadre.*

Computer systems development personnel within DIS are responsible for developing and maintaining the core systems that are used statewide. These core systems are programmed in COBOL, include batch-oriented and on-line processes, and were designed and developed to run on mainframes in the early 1980s. Accordingly, DIS development staff knowledge and skills are attuned to COBOL programs in a mainframe environment, and they naturally tend to prefer mainframe solutions to meet new system requirements. Indeed, DIS staff report that they are often described as the mainframe specialists within Caltrans.

The current technological trend, however, is unmistakably away from the current skill sets of DIS staff. The major new systems that have been developed in the past 5 or 6 years have invariably used a quite different technology set, including specialized minicomputers or

microcomputers rather than mainframes, single-purpose data networks, and specialized data bases.

DIS recognizes the need to retrain its systems development staff and develop their skills in the new technology. The 1991 Strategic Directions Plan includes establishment of a staff training and development program to develop the new skills. However, as noted earlier, DIS has not yet formally adopted a new mainframe systems development environment, including tools and standard practices. DIS staff training in the new methods has been limited to a small cadre.

Because DIS systems staff will continue to maintain and enhance existing systems until they are updated, DIS systems development staffing levels may need to grow to free staff to learn new skills while continuing to meet the demand for their existing skills.

Options

M4.1: Retrain DIS Systems Development Staff

The Strategic Directions document sets out a plan to develop a comprehensive staff training and development program by December 1993. Given the increasing range of systems technology in Caltrans, the DIS training program could consider:

- The system technologies likely to be widely used at Caltrans in the foreseeable future.
- The future systems development environment in DIS.
- The requirement to develop DIS expertise in widely used new technology (e.g., imaging systems). For example, one or more DIS staff could become imaging specialists, fully qualified to design systems using imaging and available to provide imaging application advice to users and other DIS staff.
- The requirement to develop a broad understanding among DIS staff of the uses of new technology (e.g., imaging systems). All DIS system development staff should learn where imaging technology is applicable and what it can do.
- The technology awareness needs of staff outside DIS, including managers and Caltrans staff outside DIS who are heavily involved in choosing and designing new systems.

The advantages of retraining DIS staff include:

- An enhanced ability to apply new technology to Caltrans systems requirements
- Reduced risks of systems failures, especially those that use new to Caltrans technology
- Enhanced systems expertise within Caltrans and thus less need to constantly look outside for specialists to deploy new technology.

The potential disadvantages of retraining DIS systems development staff include:

- Erosion of the number of DIS staff available for systems development and maintenance work, or the need to hire additional staff.

M4.2: Establish a System Development Supplier Network

Caltrans has historically used systems development subcontractors, especially on projects that require a knowledge of new-to-Caltrans technology. This practice could be expanded to systematically use subcontractors to provide systems development and maintenance coverage on new systems, especially new systems that use new-to-DIS technology. This approach would entail establishing a network of qualified suppliers who would be asked to bid on new work.

The advantages of using systems development subcontractors may include:

- An enhanced ability to rapidly assimilate new technology to better meet Caltrans systems requirements
- Generally faster response to system requirements
- A clear link between system development expenditures and projects.

The potential disadvantages of using systems development subcontractors include:

- A diminution of the role of DIS staff and a possible sense that DIS positions are dead-end jobs
- Increased risks of systems failures due to business failure of the subcontractor
- Reduced systems expertise within Caltrans and thus a constant need to look outside for specialists to develop and maintain systems using new technology.

Recommendations

R32: Upgrade DIS Staff Skills and Capabilities

DIS development staff knowledge and skills are currently attuned to COBOL programs in a mainframe environment; however, the current technological trend is unmistakably away from the existing skill sets of DIS staff, and DIS will need to invest in staff retraining to enable Caltrans to take full advantage of new technologies and the new systems development environment. Because of the large number and diverse nature of the new technologies, SRI believes Caltrans will need to use a judicious mixture of in-house staff and specialized subcontractors to deal with the new technologies. DIS will also need to develop a limited number of specialists in each important new technology.

The Strategic Directions document sets out a plan to develop a comprehensive staff training and development program by December 1993. SRI believes that DIS personnel and stakeholder personnel training and development is necessary, that the advantages override other considerations. Our experience indicates that the seeming cost in staff time and training expense will be handsomely returned by better equipped staff providing better systems.

SRI recommends that such a program be developed and implemented. The program should include:

- A definition of the future systems development environment in DIS.
- Provision to develop DIS staff skills in new technologies. For example, all DIS system development staff should be made aware of where imaging technology is applicable and what it can do. One or more DIS staff should

become imaging specialists, fully qualified to design systems using imaging and available to provide imaging application advice to users and other DIS staff.

- The means to meet the technological awareness needs of staff outside DIS, including managers and Caltrans staff outside DIS who are heavily involved in choosing, designing, and operating systems.
- The plan for DIS staff retraining.

The benefits of retraining Caltrans staff in new technology will include an enhanced ability to steer the application of new technology in the long-term best interests of Caltrans, fewer risks that investments in new technology will become one-off solutions that quickly become obsolete, and enhanced systems expertise within Caltrans so that Caltrans does not have to constantly look outside for specialists to deploy new technology.

Finding M5: Ineffective Planning and Budgeting

The Caltrans information services planning and budgeting process is ineffective. DIS budgets do not fully reflect the underlying demand for DIS services. Rather, DIS assembles the total demand in its work plan and then submits a budget that covers that portion of the total demand that can be met while remaining within the Caltrans staffing and budget guidelines. The relative priorities within each functional area that will be included in the budget are set in consultation with the respective functional managers.

The Caltrans information services planning and budgeting process is ineffective. Each fiscal year, DIS submits a budget in accordance with state and Caltrans budgeting guidelines. The DIS budget covers ongoing systems operation support, new systems projects, and investments in infrastructure such as DIS staff training.

DIS budgets do not fully reflect the underlying demand for DIS services. Rather, DIS assembles the total demand and then submits a budget that covers that portion of the total demand that can be met while remaining within the Caltrans staffing and budget guidelines. The relative priorities within each functional area that will be included in the budget are limited by the number of DIS staff assigned to support that function and are set in consultation with the respective functional managers.

The DIS budgeting process does restrain what might otherwise be an explosive growth in information services spending in Caltrans; however, it has several negative effects, including:

- Support for ongoing systems is necessarily accorded first priority, and the funds available for new systems projects, and especially for infrastructure development, are limited to the remaining funds and personnel after ongoing support is provided. The very slow, almost nonexistent, progress on the data base integration project clearly indicates that even worthwhile improvements can be starved for funds to the point they become moot.
- The budgeting process encourages Caltrans departments, and their DIS counterparts, to fight to maintain the authorization levels in their current budgets in order to preserve their funding levels in future budgets.

- The budgeting process fosters compromise solutions that give something to each stakeholder and discourages departures from past practices. Thus, Caltrans finds it difficult to launch projects to exploit new technologies such as geographic information systems (GIS), despite their obvious utility.

Options

M5.1: Use a Revolving Fund and Charge-Back System

DIS has been considering the use of a charge-back scheme whereby DIS would be reimbursed by its customers for services provided. In this approach, DIS expenses would be funded by a revolving fund, and DIS customer budgets would show DIS charges as an expense line item.

The potential advantages of a charge-back scheme include:

- DIS customers will be more aware of, and sensitive to, the financial effect of their request for DIS assistance.
- DIS customers will be motivated to more closely examine their needs, and to segregate needs from wants, to keep their DIS budgets in line with Caltrans guidelines.
- As in all service charge-back schemes, the expense for DIS services will be budgeted in the organization that also gains the presumed advantages.
- In some cases, DIS customers will be better able to shop for less costly services.
- The DIS budget will rise or fall as DIS customer requests and budgets for DIS expense rise or fall. DIS will be able to fully meet the requests for its services. (SRI assumes the DIS person-year budgets would follow the financial budgets.)

Disadvantages of the charge-back approach include:

- The charge-back procedure, including rate setting, budgeting, time-keeping, and periodic statements of charges, involves extra accounting and will require additional administrative staff in DIS.
- DIS customers will not be able to shop elsewhere for many of the services that DIS provides and over time are likely to resent the need to spend "their" funds for expenses beyond their control.

M5.2: Align Budgets and Work Plans

DIS reports that its staff allocation has remained unchanged since 1980 while the backlog of systems development work has exceeded the available resources for some years. Some portion of the backlog is thus necessarily postponed each year and may never get enough priority for inclusion in the budget.

DIS and its customers could agree to cancel systems development work that definitely cannot be covered in the budget. DIS work plans would therefore not exceed the available staff

allocation for any budget year. Canceled work could, of course, be brought up for consideration in the following budget year.

Advantages of aligning the DIS work plan to budgets include:

- A clearer understanding in DIS and by its customers of the work that DIS does have budgeted and will do
- A clearer picture to all concerned of what cannot and will not be done due to DIS staff allocation limits.

Disadvantages of aligning the DIS work plan to budgets include:

- The possibility that worthwhile systems proposals that are excluded from the work plan due to resource limitations will be forgotten and permanently lost.

M5.3: Appoint a Systems Steering Committee

Caltrans management could also direct that the decisions as to which proposed systems efforts will be staffed, and which will not be staffed, will be made at a higher level. In that scenario an overall authority, for instance a steering committee representing Caltrans senior management, would set systems staff deployment plans to meet overall department priorities. DIS and functional managers would no longer set the priorities and staff deployment plans.

Recommendations

R33: Appoint a Systems Steering Committee to Align Systems Budgets

SRI does not recommend that Caltrans adopt a charge-back scheme for DIS services. We do recommend that the DIS staff allocation decisions be made by a person or body concerned with the systems priorities for the whole of Caltrans, not with just one function. A systems steering committee made up of representatives from each Caltrans division is one likely solution.

Finding M6: Ineffective Management of Technology

Caltrans uses a variety of information systems technologies. That variety sometimes impedes the adoption of more cost-effective methods and makes it more difficult to simplify and streamline processes. To combat this situation, DIS is currently reducing the number of mainframe processing nodes from 12 to 4, and is phasing out obsolete IBM 370 processors. DIS also recognizes the need to replace the obsolete and orphaned PRIME computers used by Accounting.

Caltrans has no effective method for exploiting new information services technology. The current planning and budgeting approach assumes that the several functions within Caltrans can and will initiate new systems programs that use new technology to improve their operations. Outside contractors have been used to develop and implement many of the more recent systems initiatives. This approach perpetuates the division of Caltrans systems into narrowly focused islands and tends to disregard opportunities to make major breakthroughs by reengineering the whole of a basic process rather than that portion of the process that is performed in one organization.

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The variety of information systems technology in use at Caltrans impedes the adoption of more cost-effective methods and technology. To combat this situation, DIS is currently reducing the number of mainframe processing nodes from 12 to 4, and is phasing out obsolete IBM 370 processors. DIS also recognizes the need to replace the obsolete and orphaned PRIME computers used by Accounting.

Information systems technology continues to evolve very rapidly. The Strategic Directions document highlights a number of emerging technologies that are expected to affect the Caltrans systems, including expert systems, electronic data sharing, GIS, and imaging. It seems inevitable that the number of different information systems technologies in use at Caltrans will continue to grow. Thus, the current programs to eliminate obsolete computer platforms will be done concurrently with the adoption of new technologies.

DIS has identified several opportunities to make process breakthroughs that may benefit all of Caltrans, including:

- DIS believes it is technically feasible to computerize the entire project development process, from planning to publication of specifications and estimates. This process redesign project would necessarily involve a number of Caltrans functions and organizations and would clearly require an ability to launch and implement broadly based multifunction projects.
- Geographic information systems with their supporting global positioning systems (GPS) technology clearly have the potential to affect nearly every Caltrans program area.

Caltrans' present compartmentalized systems management approach does not provide a ready means to exploit these and other process redesign opportunities. Each Caltrans organization has its own systems agenda, which may or may not coincide with these multifunctional opportunities, and the DIS agenda tends to mirror the agendas adapted by the systems users that depend on DIS support. In response, the director recently established a project management data base task force to address the whole project management issue.

Caltrans is not alone in facing the need to reconsider its established processes. Business and information technology publications are presently full of multifunction process reengineering or process redesign success stories and exhortations. These case studies emphasize the need to look at the whole process, beginning by ignoring organizational boundaries and by challenging the established methods for performing the process.

Options

M6.1: Develop Standards for Managing New Technology

Given the growing technology set in Caltrans, SRI believes it is essential for DIS to develop and promulgate hardware and software standards. These standards should prescribe how DIS and others will supply and support each new technology and how the technology will be interfaced with existing technology. Minimum hardware and software specifications should also be developed.

The Strategic Directions document recognizes the need to establish standards for new technology and sets out a number of one-off programs to investigate and exploit new technologies.

The advantages of the proposed standards for new technology include:

- A higher degree of certainty that the new technology will interface smoothly with existing technologies
- Fewer failures due to unexpected technical problems.

The potential disadvantages center on DIS's ability to assign staff in a timely manner to support new technology initiatives. If qualified staff can be made available when needed, there should be no disadvantage to the proposed standard-setting procedure.

Recommendations

R34: Adopt and Promulgate Technology Standards

SRI recommends that DIS give a relatively high priority to the adoption and promulgation of standards that will govern the selection, purchase, and development of new hardware and software, including universal equipment such as PCs as well as specialized equipment. The standards should specify the minimum capabilities of the hardware or software being considered so the new hardware or software can interface with existing technology.

Finding M7: Significant Networking Requirements

Caltrans needs effective networking to allow its computers and other information-handling devices to work together. The executive summary of the Strategic Directions plan notes that the directorate has "emphasized the desire for all Caltrans knowledge workers to have electronic access to corporate data and the ability to use it competently." Nonetheless, major data exchange barriers persist.

Caltrans does have an effective data communications network. Caltrans has a major need for effective networking to allow its computers and other information-handling devices to work together. The Caltrans directorate has recognized the importance of these networking requirements. The executive summary of the Strategic Directions plan notes that the directorate has "emphasized the desire for all Caltrans knowledge workers to have electronic access to corporate data and the ability to use it competently." It strongly stated that "not only do we need accurate information but appropriate information for critical decision making by top management."

DIS operates a statewide network to meet this need. The network makes it possible for 3270 terminal users, Apollo workstation users, DEC system users, and PC users to access systems on other hardware types through a TCP/IP protocol. DIS states the Caltrans "wide area network is in place to handle current requirements, and can be scaled (up) to handle future requirements."

Nonetheless, major data exchange barriers persist. One such example is the current inability to exchange data between the Primavera and Microsoft Project systems used by project managers and the Caltrans cost systems or with the PCMS system. Primavera and Microsoft Project can import data from other systems or export data. Both use standard text or spreadsheet data formats to import or export data. Because the data communications linkages do exist, what must be lacking is an ability of the cost system and PCMS system to exchange data via the network in text or spreadsheet formats. An established data exchange procedure is apparently also needed.

Ad hoc users of Caltrans systems are also faced with the chore of deciding where to get the needed information. As noted earlier, Caltrans data are often resident in multiple systems, of varying accuracy and currency. Thus, an informed choice of data bases is a necessary prerequisite to a good result. The Data Warehouse, which focuses all project-related information, and other like systems for other data will be especially useful to ad hoc users.

Options

M7.1: Use Standard Data Exchange Formats

The current inability to exchange project information between Caltrans systems highlights the need for standard data exchange formats and for a data exchange capability in each Caltrans system. Nearly all PC-based programs can import and export spreadsheet and/or text data. Thus, Microsoft Project, a PC program widely used in Caltrans, can exchange data with most word processing or spreadsheet software. SRI suggests that Caltrans should adopt this de facto PC data exchange format. Microsoft Project and the very similar Primavera project control software for minicomputers also support graphics interchange standards, which Caltrans needs.

The adoption of standard data exchange formats implies that some means must be found to import data into or export data from the Caltrans mainframe systems, such as PCMS. DIS can meet this need by creating parameter-driven data base access and update programs that system users can apply to create new data exchanges. SQL, Focus, and other query languages used at Caltrans already provide a parameter-driven data extract capability and may assist DIS in creating a mainframe data import/export capability.

Finally, disciplined procedures must be in place to enable system-to-system data exchange. Project managers importing cost data into their project's data base must have confidence the imported cost data are correct and must do their part by faithfully following the agreed procedure. They must also understand the imported data, including how current they are and the probable data precision. For example, the managers may need to know, and make allowances for, the fact that x percent of time charges are normally delayed y days because of data input errors.

The advantages of using PC data exchange standards as one of the Caltrans data exchange standards include:

- The wide use, and large user base, of standard PC software such as WordPerfect in Caltrans
- The fact that PC data exchange standards are well established and are not likely to be superseded, although they may be expanded by some PC software vendors
- The fact that PC data exchange standards set a well-known base for DIS designers.

Recommendations

R35: Enhance the Network

SRI recommends that DIS establish data interchange standards that will allow users to import data into, and export data from, their standard PC and workstation programs such as WordPerfect, Lotus, and Microsoft Project. Presumably the data exchange between PCs and workstation users will move via electronic mail. DIS will need to make similar arrangements to exchange data between PC and workstation applications on the one hand, and the custom-built software used in mainframe programs.

Initial steps for realizing the internal data exchange capabilities will include deciding which PC software and mainframe systems will be provided with data exchange capabilities, analyzing the standard methods built into the PC software, and selecting and then implementing the Caltrans data exchange standards.

SRI expects Caltrans will also have a growing need to exchange data with other organizations, for instance contractors, which do not currently have access to the State government network. The data exchange standards recommended above for Caltrans internal use should also be useful for the exchange of data with entities outside Caltrans; however, Caltrans will need to either establish ports on its network to allow these foreign entities to exchange data with Caltrans organizations, or will need to establish such a facility via a value-added network.

Where appropriate, Caltrans staff should also be able to use the universal communication roadways to access the specialized data bases available from Compuserve and others.

PROJECT DELIVERY

Finding D1: Multiple Project Delivery Roles

Caltrans project delivery roles have evolved from simply being a highway designer to more diverse participation in transit projects. Caltrans today does not have the plan, organization, and resource flexibility to execute its multiple project delivery roles effectively. Caltrans project delivery approaches must become more flexible and responsive to the needs of the project.

In project delivery today, one finds not only state highway design projects in which Caltrans provides all of the design and project management services, but also transit projects and highway projects in which Caltrans plays a prime contractor role and buys engineering services from others, provides technical oversight services only, or performs reimbursable design work for other agencies. Traditional working relationships are changing; all customers are placing more emphasis on delivering a project quickly when needed, with fewer resources.

When it works on 100% state-funded highway projects, Caltrans' responsibilities range from coordinating and participating in planning processes, generating environmental documents, providing engineering design services, conducting real estate transactions, to overseeing both engineering and construction services. As indicated in Table II-7, however, depending on a wide range of factors, Caltrans could provide any number of services on locally funded projects or transit projects, including oversight, project study report development, environmental document development, reimbursement design work, and a pro rata share of overhead.

Recognizing its expanding roles and responsibilities, Caltrans has recently prepared a number of procedural manuals and training courses to assist in executing the multiple project development roles. Those include:

- Project Management Academy course material
- Oversight Academy course material
- Project Development Procedures manual
- Project Management Procedures manual
- Special Funded Programs procedures manual
- A-E Consultant Services manual.

The growth in special funded state highway projects and mass transit projects has resulted in the need to perform those nontraditional roles. Table II-8 shows the recent growth in resources devoted to tax measure projects. When all other special funded projects are included, the total percentage of capital outlay support devoted to the nontraditional roles is more than 20%.

Table II-7
CALTRANS ROLES AND RESPONSIBILITIES

Project Management Stage	100% Caltrans State Highways	Specially Funded State Highway Projects	Mass Transit Projects
Planning	Participate	Participate	Participate
Project Study Report	Execute	Participate	↓
Project Approval Report	↓	Oversee	No Role Unless Requested
Final Design and Right of Way	↓	↓	↓
Assembly of Bid Package	↓	Execute	↓
Advertising, Bidding and Award	↓	Execute	↓
Construction	Oversee	Oversee	↓
Maintenance and Operations	Execute	Execute	↓

Table II-8
CALTRANS PERSON YEAR EXPENDITURES ON TAX MEASURE PROJECTS

Fiscal Year	Total Caltrans Capital Outlay Support* (PYEs)	Local Caltrans Tax Measure Capital Outlay Support* (PYEs)	Measure Capital Outlay Support as a Percentage of the Total
1988/89	7,154	455	5%
1989/90	7,112	673	9
1990/91	7,751	887	11
1991/92	9,222	1,195	13
1992/93	9,201	1,250	14

* Capital outlay support numbers do not include consultants or students.

In conducting its responsibilities, Caltrans can assume a variety of organizational relationships and roles. Figure II-8 highlights three types in regards to self-help county projects.

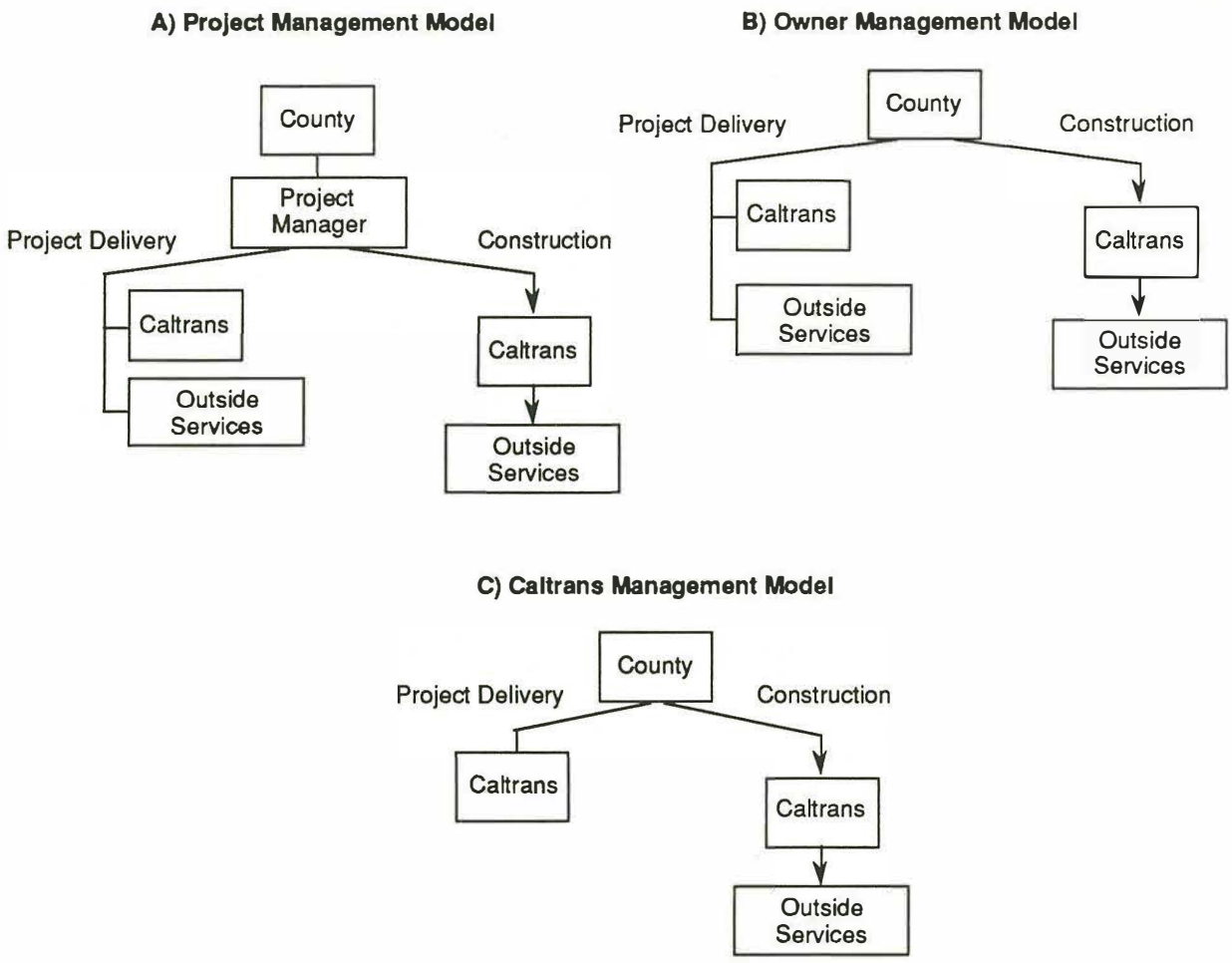

FIGURE II-8 SELF-HELP COUNTY PROJECT MANAGEMENT MODELS

In the project management model, as typified by the Santa Clara County Measure Authority, the county hires a project manager to coordinate and direct the project delivery and construction activities of both Caltrans and private firms. The project management model is often used to take advantage of project management expertise that is available in commercial servic companies and to relieve the owner (or in this case the measure authority) from the day-to-day responsibilities of pushing and coordinating many tasks at the same time. The project delivery results achieved in Santa Clara are frequently cited as a good example of fast project delivery.

In the owner management model, the county measure authority performs the project management role and coordinates and directs services that Caltrans and private firms are providing. The owner management model is used when the owner believes it has sufficient project management expertise internally and wishes to retain more direct control over the efforts of the designers and contractors. The Alameda County Measure Authority is one example of this model.

Finally, in the Caltrans management model, the county measure authority primarily contracts with Caltrans to do both project delivery and construction and effectively uses Caltrans to manage the work. The Caltrans management model attempts to eliminate the number of organizational relationships and the transaction costs associated with those relationships by using one organization to do all the work. In this model, the perceived risk of completing the project satisfactorily is reduced, but the design costs may be higher because of the lack of incentives to keep costs low when there is no competition. Both San Diego and Fresno measure authorities use this model.

All three models reflect standard approaches to managing projects. Success or failure with any of them depends on being able both to balance the emphasis and to resolve the continuous apparent conflicts that occur among scope, quality, schedule, and budget. In California, all three approaches are likely to be used in the future, although the project management model and Caltrans management model appear to be the basic choices. Regardless of which model is used, however, Caltrans must have the organization and management skills and the resource flexibility to respond to the self-help counties' needs and conduct its responsibilities effectively.

Some problems encountered by Caltrans in carrying out the nontraditional roles include the following:

- Caltrans does not have a comprehensive view of what its mix of projects and demand for services will be in the future.
- Caltrans' ability to quickly organize its resources to meet program and project delivery needs is limited by the budgeting process, the state constitution, agreements with PECG, civil service rules, and other factors.
- Nontraditional roles are not well defined. Caltrans' project development responsibilities, consequently, vary significantly depending on circumstances. "Participation" and "coordination" are often determined for the projects through negotiated agreements with the local agencies.
- When technical oversight responsibilities are not properly defined between Caltrans and the outside parties, the resources expended by Caltrans will often exceed the 15% of capital costs currently allocated.
- When Caltrans performs reimbursable work for others, it must separate its responsibilities of completing a design for an outside client and maintaining the State of California's highway standards.

Caltrans must develop the organization and capabilities to execute *both* traditional and nontraditional project development roles effectively. More human resource and technology planning must be conducted to anticipate and prepare for changing workload requirements, and Caltrans project development must become more flexible and responsive to change.

Options

D1.1: Develop Strategy for Delivering Alternate Services

One key option for the current situation is for the director's mission/value/goals implementation plan to include Caltrans' strategy for providing project delivery services and Caltrans' role in regard to nontraditional projects (including transit). Should Caltrans be actively

seeking to expand its reimbursable workload from county measure projects? What should Caltrans' mix of projects be between design and oversight? Should Caltrans be responsible only for oversight and overall program management and let outside consultants or other public organizations perform the design and construction services?

With clear objectives in these areas, Caltrans could better plan its activities, develop the suitable organization to support those objectives, and recruit and train the proper mix of resources. The disadvantage of this option is the need to obtain an agreement between the legislature and governor's office on what the roles should be.

D1.2: Develop a Long-Term Project Delivery Plan

Another option would be to develop a long-term Caltrans project delivery plan that ensures project delivery resources will be applied to the specific types and mix of projects in the foreseeable future. The plan would bring a level of integration down to the individual districts and specific projects and resources.

The advantage of this option is that Caltrans would identify and develop the necessary tools, organization, and resources to achieve its goals, and the plan would enable the organization to deliver on intermediate-term operating objectives and goals. The disadvantage is the extensive effort necessary to develop the plan, particularly in an organization that does not have strong experience in developing management plans, and the lack of management systems and a culture to implement the plan.

D1.3: Increase Caltrans' Authority to Manage Resources

An option for increasing Caltrans' responsiveness to county measure authorities and local agencies would be for the legislature to authorize Caltrans through statute and possibly constitutional amendments to balance its resources among the various assignments (including reimbursable projects), and to hire resources as required for the reimbursable work.

The advantage of providing this flexibility to Caltrans would be that Caltrans would then have the agility to respond to the bidding cycles and needs of the outside clients and still meet its own programming responsibilities. The disadvantage would be that the existing level of accountability of Caltrans to the legislature would be changed with uncertain consequences.

D1.4: Create Organizational Units for Nontraditional Roles

Another option would be for Caltrans districts to create separate units in each district for the different roles (i.e., for oversight, mass transit, 100% highway design).

The benefits of this approach would be that Caltrans would be recognizing the differences among the services being provided and develop the specific skills and experience to become more efficient in providing those services. In addition, Caltrans would likely become more responsive to outside clients' needs. The weakness would be that Caltrans could be creating the organizational boundaries of inefficiency, where many of the services being provided are similar.

D1.5: Coordinate with Local Agencies

Caltrans would work with the county measure authorities and the coalition of those authorities in developing the best approaches for managing project delivery. Those groups could

meet periodically to discuss and make commitments to each other on potential strategies for achieving state highway development objectives—what roles the respective parties could play. For example, county measure authorities preparing timely spending plans might improve the situation. In addition, comparing experiences with the different organizational approaches used by the county measure authorities and sharing lessons learned may improve the performance of everyone involved.

D1.6: Experiment with New Project Delivery Approaches

In this option Caltrans would evaluate the use of new planning, design, and construction models on an experimental basis for some selected capital projects. Those models could include the use of design and build contracts, and project management only contracts. Currently, Caltrans has few options for designing and building capital projects (unlike local agencies and county measure authorities). In some circumstances, it may be better for Caltrans to use complete design and build contracts, lump-sum contracts for engineering, or partnership arrangements with the private sector for conducting the work.

With this option, Caltrans could experiment with the different mechanisms, without major risk, and then develop the new approaches based on the results. The long-term benefit is that Caltrans would have more flexibility to perform its multiple project delivery roles and deliver more cost-effective projects. The disadvantage of this option is that statute and policy changes are likely to be required.

Recommendations

The basic focus of our recommendations for improving Caltrans execution of its multiple project delivery roles is to integrate project delivery considerations explicitly into the overall strategy planning of Caltrans, define Caltrans' many different roles better, and orient the organization and skills of the organization to those multiple roles.

R36: Develop Strategy for Delivering Alternate Services

We recommend that the director's mission/values/goals implementation plan include Caltrans' strategy for providing project delivery services and Caltrans' goals for providing alternate services (including transit delivery services). This action will be linked to developing a long-term project delivery plan.

R37: Extend the Statewide Transportation Planning Process: Define Caltrans' Responsibilities in Project Delivery

At present, no set policy on Caltrans' multiple project delivery roles exists. We recommend that the flexibility to undertake nontraditional project delivery activity be evaluated in the CTP and that Caltrans implement any subsequent recommendations.

R38: Develop a Long-Term Project Delivery Plan

We believe that Caltrans needs to develop a long-term project delivery plan for internal planning and control purposes. Because the department does not have such a plan, it does not generally sequence project activities and identify resource constraints on a multiyear basis. The

plan would integrate delivery requirements for all projects and balance resource and priority needs for at least the next 5 years. Key outputs of the plan would be intermediate project delivery goals and objectives for districts and functions within districts, including multiyear budgets.

The implementation of this recommendation will support SRI's other recommendations to develop a comprehensive project delivery control system, to reduce the number of projects in Caltrans' project delivery pipeline, and to improve the professional staff planning process. In addition, preparation of an integrated project delivery plan will be facilitated by implementation of SRI's recommendations for improving Caltrans' MIS tools and integrating staff planning (see Recommendation R15).

R39: Increase Caltrans' District Authority to Adjust Resources to Meet Changing Workload Demand

To increase Caltrans' flexibility in responding to changing market conditions and project delivery circumstances, district Caltrans management should be authorized to balance resources among the various project delivery assignments (including reimbursable projects) and to hire resources as required for reimbursable work being conducted for county measure authorities and local agencies. This recommendation is linked to recommendations for seeking a constitutional amendment to provide Caltrans flexibility in performing its work through contracting out, for implementing a management control system that sets measures and holds division managers accountable for their performance, and for seeking opportunities to provide monetary and nonmonetary rewards and punishments for organizational groups and individuals.

R40: Dedicate Individuals or Organizational Units within Districts to Alternative Roles

For Caltrans to be more effective in performing its multiple project delivery roles, we recommend that in each district individuals be dedicated to or separate units be created for the different roles (e.g., for oversight, mass transit, 100% highway design).

R41: Coordinate with Local Agencies

SRI recommends that Caltrans should meet periodically with the county measure authorities and the coalition of those authorities to transfer learning about best practices and to develop better approaches for managing project delivery.

R42: Experiment with New Project Delivery Strategies

Caltrans needs to be proficient in using several project delivery approaches to be able to provide cost-effective services for the variety of project types with which Caltrans is involved. To become proficient, Caltrans should evaluate the use of several different planning, design, and construction models on an experimental basis. Those models include the use of design-and-build contracts for complex, urgent projects; project management only contracts for large, complex projects; lump-sum contracts for engineering; or new partnership arrangements with the private sector.

Finding D2: The Factory Process

Caltrans' pipeline of projects resembles a job-shop factory with fixed functional stations. Each function is working on many projects at the same time. The challenge is to balance resources and deliver a large number of unique projects each year. Implementing Caltrans' new project management objectives on top of this factory-like process may not work unless specific allowances are made for the number of projects involved and the need for strong functional areas. Caltrans needs to develop a unique project delivery approach that ensures strong project level and functional control.

Caltrans needs a project management philosophy that fits Caltrans' project workload; otherwise:

- Project managers will not be able to achieve their responsibilities.
- Many of the project delivery performance expectations will be unmet.
- Caltrans will lose opportunities with regional agencies to provide project delivery services.

Caltrans' basic project management objectives as stated in the Caltrans Project Management Procedures Manual are to:

- Assign a project manager to be responsible for a project from its inception to completion
- Assign individuals from the necessary technical support functions to work with the project manager. The functional manager is responsible for selecting the individuals to work on a project
- Plan, process, monitor, and control all project efforts at the project level, under the direction of the project manager (i.e., the project manager has the authority to commit project staff resources and direct staff efforts)
- Make each individual working on the project team accountable to the project manager for meeting the project goals by delivering their portion of the project work within schedule and budget.

Caltrans started the implementation of its project management objectives in 1988; over the last 5 years, the organization has made significant strides toward implementing those objectives. Important achievements include:

- Dissemination of project management procedures and descriptions of good practices throughout Caltrans
- Creation of a Project Management Academy to help develop Caltrans' project and functional managers
- Development of prototype planning and scheduling tools (e.g., Primavera) for each district
- Completion of a project management peer review in 1992-1993 with outside project management experts

- Assignment of all projects to project managers
- Development of project management procedural manuals in each district
- Leadership by the director on project management
- In some districts, reorganization to accommodate explicitly the project management approach.

Caltrans, however, is still struggling to find the right balance in its management strategy, organization, and systems to obtain the benefits of managing by project when hundreds of projects are involved. The number of projects being delivered at any one time is highlighted by the Office Engineer's monthly status report (Table II-9), which tracks projects that are approaching the point of being ready to advertise or are being advertised. As seen from this table, at the end of the 1992/1993 fiscal year Caltrans had more than 600 projects coming out of its project delivery pipeline.

Table II-9
SUMMARY OF PROJECTS IN OFFICE ENGINEER STATUS REPORT
(AS OF 6/30/93)

District	Number of Projects	Construction Dollar Value (millions)
1	39	$ 45
2	55	55
3	37	38
4	159	1,220
5	32	16
6	38	68
7	89	229
8	66	112
9	11	12
10	36	22
11	57	157
12	28	124
Total	647	$2,098

To achieve Caltrans' project management objectives requires a project manager able to devote his or her time to project issues. At present, project managers have too many projects or too many other duties to perform their stated project manager responsibilities. Interviewees frequently commented on the number of responsibilities of each project manager and the inability of the project managers to delve into project issues. They also stated that project managers generally have little authority and do not make decisions concerning cost, schedule, scope, or quality in functional areas outside of their own project development domain. In general, project managers have too many project and functional responsibilities to do anything more than react to short-term issues and problems. Table II-10 highlights the large number of programmed projects being managed by the current set of project managers.

Table II-10
NUMBERS OF PROJECT MANAGERS AND PROJECTS

District	Number of STIP, SHOPP, and TSM Projects*	Dollar Value of Projects* (millions)	Number of Project Managers
1	43	$ 187	4
2	52	152	10
3	86	332	12
4	258	1,270	19
5	71	388	10
6	65	428	16
7	168	813	36
8	78	510	14
9	29	209	5
10	71	374	11
11	83	405	23
12	60	366	7
Total	1,064	$5,437	167

*Excludes locally funded, tax measure, and long lead time projects, which can also represent a significant number and dollar-value of projects

A key feature of Caltrans' project delivery process is that it resembles a job-shop production line with fixed stations. Each project is unique, but generally each station works on each project. At any one time, several projects are being worked on or are in the queue at each station. A major challenge for the manager of each station, then, is with fixed resources to achieve each project's scope, quality, cost, and schedule objectives in an environment subject to frequent changes. To achieve efficient performance, the project manager must provide for the following:

- Allocating project assignments and resources to functional areas and locations—essentially, capacity planning
- Determining the sequence of project completion; that is, establishing project priorities
- Initiating the performance of the scheduled work. (In factory language, this is dispatching the work.)
- Functional-area control (or project task control) involving:
  - Reviewing the status and controlling the progress of projects as they are being worked on
  - Expediting late and critical projects
- Revising the schedule in light of the changes in project status.

The functional manager must balance many competing interests and still deliver. Implementing Caltrans' new project management objectives on top of this factory-like process may not work unless specific allowances are made for the number of projects involved and the need for strong functional areas.

Options

D2.1: Develop Strong Role for Functional Managers

In this option, Caltrans would implement an approach that emphasizes the control and authority of the functional managers in project delivery. Functional managers would retain authority over resource assignments to meet functional responsibilities and project technical details for their function. Coordinators would be used to shepherd individual projects through the system.

The strength of this option is that it explicitly recognizes that Caltrans' project delivery resembles a production line where similar projects are being produced. The weakness is that the approach is not very effective when large, complex projects, or nonstandard projects, are involved, or schedules need to be accelerated.

D2.2: Push Beyond Current Project Management Model

The second option would be to continue development of the Caltrans project managers' role with the goal of giving them control of the resources on a project and holding them responsible for meeting cost, schedule, scope, and quality targets. The functional managers' authority in the management of these projects would be limited and their primary responsibility would be to assist in providing the necessary functional resources to the project.

The strength of this approach is that there would be a single person responsible for a project and with the control to achieve the individual project objectives. The weaknesses are that:

- Overall program goals would be more difficult to meet.
- Managing changing priorities among a number of small projects with fixed staff levels is a challenge.
- Caltrans' current culture and functional managers would resist this approach.
- Personnel may be anxious about being taken from their functional areas and their normal career path.

D2.3: Develop a Hybrid of the Factory and Project Management Models

In the third option, certain projects (e.g., greater than $100 million in construction costs) would be managed by a full-time project manager along with a team of functional resources assigned to the project. A set of criteria would be developed for identifying those projects that are more complex, sensitive, or large, requiring special handling. For those projects, the project manager would operate as in a traditional project management model with the authority to direct the functional resources and make trade-off decisions as required. Small projects would continue to be managed by the functions and a planning function.

This option would take advantage of the strengths of the first two approaches, but it also would introduce the complexity of managing two approaches in a district and the risk of two project management cultures developing.

D2.4: Mandate a Statewide Project Delivery Approach

In this option, Caltrans would adopt one project management approach statewide; individual districts would not have the authority to choose whatever form they wished to implement. The statewide approach would be flexible to the different needs, but not to the point that radically different approaches were used on similar types of projects. The strengths of this option are that a common set of tools and measures can be developed, skills and resources can be easily transferred among districts, and lessons learned in project delivery can be used more easily.

D2.5: Give Each District the Choice of Project Delivery Approach

In this option, individual districts would choose what fits best for them. The strength of allowing districts to choose for themselves is that they can select an approach that best fits the local needs and produces the desired results. District managers, however, are not necessarily strong project management or organizational judges, and this approach could lead to 12 suboptimal solutions (some of which will be very weak).

D2.6: Focus Resources and Shorten Durations to Increase Overall Productivity

After developing an overall Caltrans plan that ensures project delivery resources will be applied to the specific types and mix of projects, and after selecting the project delivery philosophy, in terms of whether to emphasize a factory production or traditional project management philosophy, Caltrans will need to develop a realistic delivery plan that balances demand for and supply of resources. In Caltrans, the demands or opportunities for delivering projects (state, special-funded, and local) exceed the capacity of available Caltrans resources to work on them. When resources are overextended, productivity declines, the number of projects in the pipeline increases, projects take longer to complete, and the rate of project completions falls. To counteract this situation, Caltrans should dramatically reduce the number of projects under way at any one time, but also focus on refining the cost and duration estimates. Enabling steps to reduce the number of projects would be to develop:

- A multiyear delivery plan that includes all projects and fits multiyear budgets to multiyear projects
- A system for making decisions on contracting out at the program level so that reimbursable project work and contracting-out work can be planned and balanced together.

The benefit of this option over the long term is that resources would become more focused, project delivery durations would shorten, and overall productivity would increase. The result is a higher capacity to deliver projects. In addition, contracting out at the program level would provide Caltrans significant flexibility to use outside consultants and reduce the necessity of defining contracting-out needs 18 months in advance. The difficulty in implementing this option is that it requires information systems and management skills.

Recommendations

SRI believes that one project delivery model cannot be efficient for the spectrum of design projects that Caltrans undertakes. For less complex projects, we recommend a strong role for the functional managers and a planning function with project coordinators. For complex projects,

we recommend an enhanced project manager model with more authority on project issues being passed to the manager. The early screening process (as described in an earlier recommendation) will identify those projects that are more complex, sensitive, or large, requiring special handling.

R43: Develop the Hybrid Project Delivery Approach.

Caltrans will need to improve both its functional management and project management approaches to make this recommendation work. To make the functional management (or factory system) work, Caltrans will need a strong planning function to set factory priorities, coordinate project schedules, and manage the interfaces between functions. In addition, the functional manager approach emphasizes the control and authority of the functional managers in project delivery, and as a result, functional managers will need to retain authority over resource assignments to meet functional responsibilities and project technical details for their function.

A key requirement of managing the functional groups as a total system will be to develop function balancing strategies to ensure high overall system efficiencies. For example, it may be most efficient to overstaff certain functions that act as bottlenecks for the entire project delivery process in a district. It also may be necessary to develop project task breakdown strategies that break the project delivery support scope into small pieces to obtain maximum flexibility through the bottlenecks.

For the complex projects (and not just large projects like the Century Freeway and Cypress Rehabilitation), the project manager approach will be used. A single individual will be given control of project resources and held responsible for meeting cost, schedule, scope, and quality targets. The functional managers' authority in the management of these projects will be limited, and their primary responsibility will be to assist in providing the necessary functional resources to the project. A project manager will be able to contract out if the functional managers cannot provide the resources to perform the work efficiently.

R44: Mandate a Statewide Project Delivery Approach

SRI recommends that Caltrans adopt the hybrid functional- and project-management approach statewide and that individual districts not have the authority to choose whatever form they wish to implement. With one approach, a common set of tools and measures can be developed, just one set of project management definitions and guidelines need be developed, skills and resources can be easily transferred among districts, and lessons learned in project delivery can be adopted more easily throughout Caltrans.

R45: Focus Resources and Shorten Durations to Increase Overall Productivity

To improve its productivity on projects and its project delivery cost and schedule performance, Caltrans should focus its resources and dramatically reduce the number of projects under way at any one time. The result will be fewer starts and stops on projects and higher labor efficiency. To accomplish this, Caltrans will need to focus on refining the cost and duration estimates, sequencing project activities, and holding functional groups accountable for meeting their support cost and schedule commitments. The implementation of this recommendation will depend on the implementation of other key recommendations to:

- Provide Caltrans' district and functional management with the flexibility to plan resources at a program level and use outside resources as needed to meet program and project delivery goals
- Develop a multiyear delivery plan that includes all projects and fits multiyear budgets to fit multiyear projects
- Develop management planning and control tools
- Reduce the number of active projects that individuals are assigned at any one time. Individuals should generally not be assigned more than five active projects or major tasks. Project managers that also have functional manager responsibilities should not have more than five projects
- Eliminate the requirement that every project be assigned to a project manager
- Create "floating resources" to be used as needed to address bottlenecks.

Finding D3: Multiple Stakeholder Involvement

Public infrastructure projects are characterized by their extensive external stakeholder involvement and long time frames for defining project scope. Caltrans requires a flexible approach that can respond to the multiplicity of stakeholders, develop early consensus and commitment among those stakeholders, integrate the concerns and needs of multiple internal stakeholders, and yet still be subject to management control.

Caltrans' project delivery is subject to repeated intervention by a multiplicity of external stakeholders. This involvement now includes developing regional consensus on project selection; achieving support from the CTC to include a project in the STIP; compliance with National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) requirements; approval, agreements, or permits from a variety of local, state, or federal agencies; and the concurrence of community and special interest groups that can use a variety of approaches to delay approval of a contested project.

Figure II-9 shows the stages of a project and the relative amounts of stakeholder involvement at each stage and how much the scope, cost, and schedule can change as a result of this involvement and federal and state laws. Particular problems include federal or state agencies that do not buy into assumptions or alternatives until late in the environmental analysis process, or retroactive applicability of new standards or regulations adopted between completion of environmental review and acquisition of final permit approvals. Many of the stakeholders have limited resources and no compelling need to adhere to Caltrans' project delivery schedules. Even more frustrating for everyone, Caltrans' current project delivery measures for schedule milestones and construction costs, as required by state statute, do not adequately allow for these circumstances.

Because of the increased involvement of local agencies and communities in the planning and preliminary project development stages, a key factor of success in project delivery today is dealing with the external stakeholders. A new project delivery criterion for Caltrans could be said to be: Is the project "ready for public consumption?"

NEPA and CEQA drive the requirements for external stakeholder involvement to a large degree. NEPA requires full consideration of project scope alternatives in the environmental document. From the time a project appears in the programming document until the environmental document is approved, Caltrans must fully consider several alternatives and not focus just on one. As a result, the environmental document development process is often the mechanism for resolving social and political issues in addition to environmental issues, and external stakeholders use the process to raise objections to the project. On the other hand, by the time a project appears in a programming document, the MPO or RTPA, CTC, and other entities have already decided about mode, general location, scope, cost, and schedule. None of these decisions is made in the context of NEPA or CEQA; in effect, the environmental document does not fully consider the alternatives.

Another constraint imposed by NEPA and CEQA is that Caltrans is prohibited from beginning most right-of-way activities until after the environmental document is approved. This means that right-of-way is often the critical path activity prior to the project being ready to list for construction advertising.

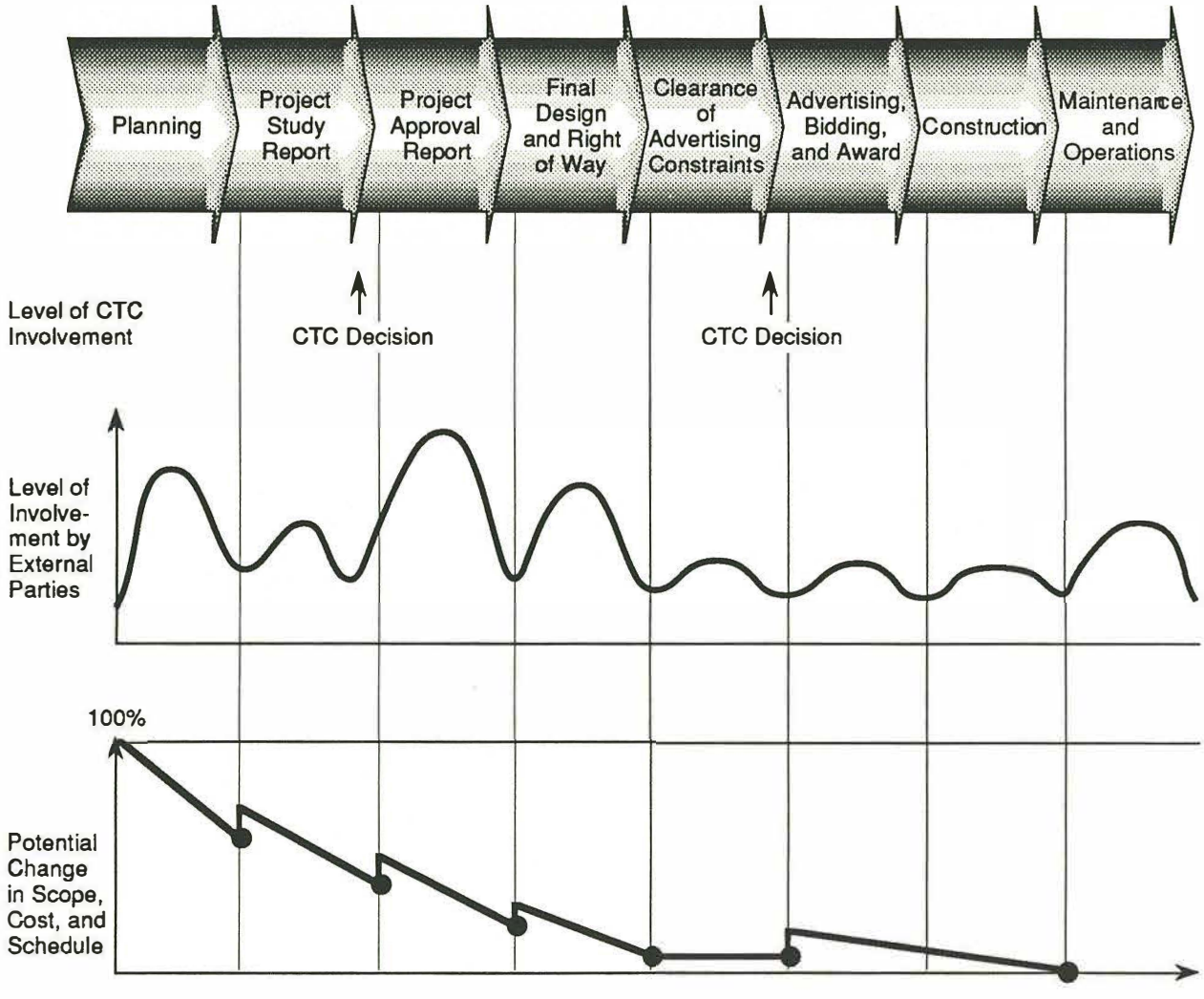

FIGURE II-9 PUBLIC INFRASTRUCTURE PROJECTS

Most projects are either categorically exempt (CEQA) or categorically excluded (NEPA), or a Negative Declaration can be filed on the project; therefore, only a small percentage of Caltrans projects (on the order of 10 to 20 per year) require thick Environmental Impact Reports or Statements (EIRs/EISs). Nevertheless, Caltrans probably produces more EIRs/EISs per year than any other state agency in the United States, and even those projects in the categorically exempt or categorically excluded category often require extensive environmental clearance processing.

In general, Caltrans conducts the environmental studies thoroughly. Caltrans is known for its comprehensive knowledge of the permitting and review requirements. Caltrans, however, is not known for taking risks in the process or varying its procedures.

Environmental and permit issues are often more critical to project success than engineering design. Aside from NEPA and CEQA, major federal and state regulatory requirements that need to be met include:

- 1990 Clean Air Act amendments administered by the U.S. Environmental Protection Agency (EPA)
- Endangered Species Act, federal and state
- Section 106 of the Historic Preservation Act, cleared through the State Historic Preservation Office and FHwA
- Clean Water Act administered by the Corps of Engineers, including Section 404 permits for wetland impacts
- Stream Beds (Section 1601) administered by the State Department of Fish and Game
- Uniform Relocation Act
- Bay Conservation Development Commission
- State Coastal Act
- State Clean Air Act
- Federal Transportation Improvement Plan
- Other requirements related to scenic resources, parklands, and stormwater discharge.

At times, plan changes identified at the permitting stage require additional environmental review, and conflicts between single-issue regulatory requirements are not unusual. Many consensus agreements and compromises are required. Numerous overlaps exist between the federal and state regulations (e.g., between NEPA and CEQA). Key agencies involved include FHwA, Fish and Game, Fish and Wildlife, Corps of Engineers, regional water and air quality boards, and the U.S. EPA. Hierarchical protocols among the agencies also exist (e.g., Caltrans must work through FHwA to address issues with the Historic Preservation Office and the Advisory Council on Historic Preservation).

Resource levels in state and local resource agencies apparently limit their ability to participate in early planning and discussion meetings on environmental issues. As a result, key issues often emerge late in the development phase. The resource agencies also use the late hour to obtain concessions from Caltrans.

In the end, to reduce the time it takes and the support costs for public infrastructure projects, Caltrans will need to develop specific skills and implement distinct project management approaches. An improved process of regulatory agency and stakeholder involvement is required. Elements necessary to improve the overall process include:

- Significant, up-front planning and coordination to work with the multiple stakeholders and resolve the scope, permit, and resource issues
- Strong consensus and negotiation skills to communicate effectively with the stakeholders, integrate their concerns, and develop their commitment
- A flexible project management approach to deal with the externally driven complexities of public-infrastructure projects
- The integration and overlap of planning, design, and environmental activities.

Options

D3.1: Mandate Early, Timely Responses from External Stakeholders

A major objective is to develop an improved process of regulatory agency and stakeholder involvement in the planning process. One option for achieving this objective would be to mandate through statute and regulatory changes timely responses from regulatory agencies and other stakeholders. In doing so, external agencies and special interest groups would be forced to buy-in or object to projects at the planning stage rather than questioning basic assumptions later during the environmental analysis stage. Under the assumption that "silence in the process represents concurrence," the lack of objection at the planning stage would reduce the grounds for challenging a project during the design phase. State and federal agencies would commit to timely review and issuing of permits or forfeit the opportunity to regulate.

The advantage of this option would be that more comprehensive stakeholder discussion and involvement in the planning process, and a simplified approval process for projects, consistent with adopted plans that have approvals and sign-offs, would force early conflict or buy-in, not last-minute challenges and extensive redesign. Individual projects would move through the design and approval process more rapidly with absolute deadlines for comments. As a result, Caltrans would also have more confidence in its ability to deliver projects on a timely basis. This option appears to be consistent with legislative efforts to improve the CEQA process.

The disadvantages would be that a more extensive and inclusive planning process would be required, and Caltrans could be locked into scope early in the process unless it was willing to go through a second approval process. Because many stakeholders only get involved late in the environmental and permit process, this approach may also be politically unpopular. Many permits and certifications, such as for wetlands or right-of-way, would still be required at conclusion of design prior to acquisition. This option would also require changes to federal and state regulations and possibly laws.

D3.2: Obtain Earlier Stakeholder Involvement and Commitment

An alternative option to forcing involvement by resource and local agencies through changes in statutes and regulations would be to establish a multi-stakeholder task force to improve the system and process for obtaining those agencies' approvals and permits. The task force would be

charged with reducing the bottlenecks, eliminating the potential for rework, and developing mutually acceptable project solutions.

Working with federal and state agencies to simplify the project approval and permit process should provide Caltrans many dividends in delivering projects. This task force approach would also build on the recent success of a joint state/federal task force to eliminate the bottlenecks and conflicts associated with implementing Section 404 under the Clean Water Act (wetlands impacts). The disadvantages of this approach are the possible difficulties in getting additional agencies and agency staffs to buy into revising the process, the time needed to improve the process, and the possibility of failure of the whole option.

D3.3: Devote More Caltrans Resources to Planning Stages

Another mechanism to obtain early buy-in of resource and approval agencies and reduce resource needs later in project delivery would be for Caltrans to devote more of its resources to the planning, Project Study Report (PSR), and early project development stages of a project. To improve project delivery effectiveness, Caltrans could also spend more time reviewing county and city plan reviews.

The disadvantages of spending more resources early in the project delivery process are that capital outlay support resources may be spent on ideas that never become projects, and measuring their benefits could be difficult.

D3.4: Adopt a Split-Level Funding Approval Process

Another major option would be to adopt a split-level project and funding approval process in which a preliminary STIP listing would allow preparation of a project report and an environmental analysis without committing to schedule and budget. Schedule and cost estimates would still be prepared, but those estimates would not form the basis for evaluating Caltrans' overall project delivery efficiency. Final listing on a shorter delivery STIP would include more certain schedule and cost information.

An advantage of a two-tier system is that Caltrans would be encouraged to develop a strong project definition prior to the environmental analysis and to develop the best possible project without fear of missing scheduled project delivery dates. The result would also be fewer scope and budget changes during the STIP process.

A disadvantage of the two-tier STIP would be a more complicated project delivery process. In addition, CTC has already implemented mechanisms to prevent projects from being programmed into the first 2 years of the STIP when the scope is still uncertain (i.e., when the project report is still not complete), and modification of that system may not generate additional benefits. In addition, environmental documents and permits cannot be finalized until design is 100% complete; the risk of additional project delivery effort and expense associated with finalizing those documents has not been eliminated.

D3.5: Give Resources to Control Agencies

Another option would be to provide sufficient resources to the control agencies and eliminate the barriers those agencies face in providing timely service when they conduct their reviews and issue permits to Caltrans. Resource agencies often do not comment on Caltrans

projects until late in environmental or permit process because of limited resources and/or regulations that require responses in a fixed period of time after initiating formal evaluation.

The commitment to provide resources to control agencies to participate more extensively early in the process would reduce the need to redesign projects because of late comments or mandated mitigations (holding Caltrans hostage for approvals) and thus improve schedule and budget performance. The disadvantages of redirecting funds to the control agencies would encourage control agencies to rely on Caltrans for budget support, furthering precedence of "high permit fees," and there would be no guarantee that the agencies would provide the timely input.

D3.6: Delegate More Authority to Caltrans

An option for reducing the stakeholder involvement would be to allow Caltrans to certify compliance with federal requirements on non-interstate projects. ISTEA reduced the number of federal certifications required on non-interstate projects using federal funds, and legal remedies would still be available in cases of improper action. The objective would be to regulate by exception rather than by rule.

Multiple external environmental document, right-of-way, endangered species, wetland, and air quality compliance approvals could be eliminated, thus improving the speed of project delivery process. This option would also be consistent with efforts to "reinvent government." A possible disadvantage is that this option may be politically difficult to achieve, particularly if federal and state agencies differ in their approach to environmental policy.

D3.7: Experiment with Risk-Taking Approaches

In this option, Caltrans would attempt to take risks in the scheduling of project delivery activities and in the functional approaches to the work on some selected projects. This could include overlapping detailed design (going to the 35% design stage) with preparation of the environmental document and reducing allowances for right-of-way.

The benefit of experimenting with risk taking is that a better understanding of the risks involved will develop, and major opportunities from accelerating the schedule (including reducing costs and minimizing redoing work) may be discovered. The disadvantages are that the experimentation may result in some projects incurring higher than normal costs to complete, and the results may be inconclusive.

D3.8: Develop Early Project Screening Technique

Caltrans would develop an explicit means for identifying long lead time or complex projects in the planning and PSR stages. The long lead time or complex projects would then be provided additional planning and conceptual design resources to ensure that the major risk issues were identified and more thoroughly evaluated early. The remaining projects would receive less attention, perhaps more risk taking would occur on those projects (e.g., overlapping preparation of the environmental document and detailed design), and expedited procedures might be used (e.g., minor projects could receive funding approval from the CTC executive director rather than requiring a full board vote). The advantage of this approach is that resources would be allocated to those areas that pose the greatest risk to successful project delivery. Early identification and resolution of major problems would occur, and better estimates of the project delivery efforts

would be developed. The disadvantage of this approach is that even more resources would be expended early in the process before it was certain that the project would be funded.

Recommendations

We recommend that significant action be taken to rationalize the process of involving regulatory agencies and other stakeholders in project planning and early project development. The current approaches essentially do not work and result in much longer project delivery durations and higher project support costs than are necessary.

R46: Simplify the Project Approval and Permit Processes to Obtain Earlier Stakeholder Involvement and Commitment

We recommend establishing a multi-stakeholder task force to improve the system and process for obtaining external stakeholders' approvals and permits. This recommendation was selected over the option to mandate, through statute or regulatory changes, timely responses from the agencies or other stakeholders because a consensus agreement at this stage is likely to generate a more real commitment by the other stakeholders.

The task force would be charged with reducing the bottlenecks, eliminating the potential for rework, and developing mutually acceptable project solutions. The goal of the task force will be to obtain the commitment of external agencies and special interest groups to buy-in or object to projects at the planning stage rather than questioning basic assumptions or challenging a project during the design phase. State and federal agencies would also commit to timely review and issuing of permits or forfeit the opportunity to regulate.

R47: Devote More Caltrans Resources to Planning, PSR, and Early Project Development Stages

Another important mechanism to obtain early buy-in of resource and approval agencies and reduce resource needs later in project delivery will be for Caltrans to devote more of its capital outlay support resources to the planning, PSR, and early project development stages of a project. This change will require a shift in resources from projects close to delivery to projects in their early stages of development. It also means that the factors used to estimate early stage resource requirements will need to be increased.

R48: Adopt a Split-Level STIP Funding Approval Process

To avoid the situation where initial STIP estimates are treated as fixed delivery commitments, Caltrans should initiate a split-level project and funding approval process in which a preliminary STIP listing will allow preparation of a project report and an environmental analysis without committing to schedule and budget. Estimates of schedule and budget will still be required, but they will be treated as preliminary. Final listing on a shorter delivery STIP will include more certain schedule and cost estimates.

R49: Experiment with Risk-Taking Project Delivery Approaches

Consistent with the characterization of a project's risk in the planning stage, Caltrans should experiment with project development approaches to identify alternate approaches for different

project risk circumstances. The objective would be to experiment, assuming more schedule risks and using fast-track procedures. Potential approaches to test could include overlapping detailed design (going to the 35% design stage) with preparing the environmental document, and reducing allowances for right-of-way.

R50: Develop Early Project Screening Technique

We recommend that Caltrans develop an explicit procedure or set of criteria for identifying long lead time or complex projects and characterizing their risks in the planning and PSR stages. The long lead time or complex projects will then be provided additional planning and conceptual design resources to ensure that the major risk issues are identified and more thoroughly evaluated early. The remaining projects will then receive less attention. This recommendation ties closely with the recommendation to implement a comprehensive control system. The results of the early project screening and risk evaluation will be used in estimating resource requirements for the project, setting performance goals for functional and project managers, and assigning resources to the projects.

Finding D4: Contracting Out to Facilitate Project Delivery

Caltrans' resource allocation procedures require planning for the use of outside consultants approximately 18 months in advance. In addition, Caltrans' procedures to process consultant contracts take at least 8 months to complete. The cumbersome planning and contract administration processes for contracting out limit Caltrans' ability to meet its overall project delivery goals and contribute to problems in relationships with external consultants. Opportunities to respond quickly to local needs, take risks, and deliver projects cost-effectively, which are provided by the flexibility to contract out, are missed.

The main issues of the contracting-out debate are described earlier. The discussion in this section focuses on issues related to oversight and contract administration only.

Caltrans' objectives in contracting out are to:

- Improve resource leveling within Caltrans and respond to peak load situations
- Respond to emergencies
- Obtain specialized services when needed.

In FY1992/1993, Caltrans contracted out approximately 12% (1,285 PYEs) of the total PYEs for capital outlay support staffing. When compared to only the PYEs that could potentially be contracted out (and not to all capital outlay support PYEs), the contracted-out PYEs as a percentage of the total is nearer to 20%. Before the dispute between PECG and Caltrans, in FY1993/1994 the total capital outlay support staff PYEs was expected to fall 5% and the contracted-out portion was expected to decrease to approximately 11% (1,140 PYEs).

For more than 400 contracts completed, Caltrans personnel gave the consultants average overall performance ratings of 7.5 to 8.0 out of a maximum of 10. This overall performance would appear acceptable, although many interviewees in Caltrans districts and at headquarters complained about the outside consultants not producing drawings in accordance with the contract specifications. On the other hand, the consultants provided many examples of inefficiencies in

the Caltrans oversight and review process that resulted in conflicting directions at different stages in a contract or slow response times to consultant submittals and need for decisions. Consultants also complained about a double standard being applied to their work. While this accusation is largely related to the difference in opinion over compliance with drawing specifications, Caltrans personnel did acknowledge that as public servants they felt obliged to interpret procedures and standards strictly and avoid any appearance of giving consultants undue benefit.

Whatever the cause, the gap between the understanding and expectations of the architect and engineering (A&E) consultants and those of Caltrans at both the organizational and personnel levels is large. The two groups do not work together as partners, but as two parties on opposite sides of a table. The desire to develop close working partnerships with external consultants and the directives on ethics, which are designed to institute an arms-length relationship, also conflict. Two key needs appear to be better communication between the parties early and throughout a project and a strong emphasis on developing strong working relationships—partnership-like—between the parties.

A much larger problem appears to occur in the whole area of contract administration. Caltrans' procedures to process consultant contracts take at least 8 months to complete. Reasons for the long duration include:

- Consultants are prequalified only for bids up to $250,000. As a result, each bid opportunity for contracts greater than $250,000 requires the submittal and review of consultant qualifications.
- A lengthy pre-award audit process is required.
- After a district negotiates a contract with the selected consultant, headquarters units for contracts, legal affairs, and contracting out must review and approve.
- After the headquarters review, the package must go to General Services for final approval.
- Many interviewees described contract arrangements not suited for professional services contracts. Contracts are not flexible and do not allow for change orders and contingencies; if the scope changes, the entire contracting-out process must be repeated. These time-and-materials contracts are also not conducive to holding consultants accountable for their performance.

In addition, Caltrans must budget by project where it needs to use outside consultants. As a consequence, because of the cycle time for the annual budgeting process, Caltrans must know of its project needs approximately 18 months in advance. Efficient planning of outside consultant usage is difficult to accomplish when project priorities, schedules, and resource requirements are changing more frequently.

In the end, the cumbersome planning and contract administration processes for contracting out limit Caltrans' ability to meet its overall project delivery goals and contribute to problems in its relationships with external consultants. Opportunities to respond quickly to local needs, take risks, and deliver projects cost-effectively, which are provided by the flexibility to contract out, are missed.

Options

D4.1: Reduce Contracting-Out Administration Requirements

The goal for the time period to advertise and award an A&E contract for a project should be about 1 or 2 months, depending on the complexity of the project. Potential options for reducing the time required to hire an outside consultant include:

- Eliminating the involvement of Caltrans headquarters in the contracting-out process (delegating all authority on contractual and commercial issues to the districts)
- Changing the practice of conducting pre-award audits on each project and instead conducting only annual, interim, or end-of-project audits
- Allowing Caltrans to issue A&E contracts without obtaining approval by the General Services Department
- Ensuring that a separate unit in each district is responsible for administering the contracting-out process and the contractual and commercial details of the contracts.

The advantages of reducing the time to contract out would be reduced costs of administration, more flexibility in using outside consultants to assist in project delivery, and improved relationships with the outside consulting community. The disadvantages would include the significant investment in management time and political capital to change the policies and practices, and the potential for increased contractual problems as a result of inexperienced district administration.

D4.2: Change Contractual Terms

Another set of options to increase the flexibility in using outside A&E consultants involves changing the contractual terms and conditions, through statute and policy changes, to reflect the nature of the assignments. Those changes could include the use of change orders and contingencies, and the contract manager could be authorized to decide these issues during the project. The changes could also include the use of fixed-price contracts, fixed billing rates, and performance warranties and guarantees.

In addition to giving Caltrans additional flexibility in using outside consultants to meet its project delivery needs, the changes could also improve the productivity of the consultant/Caltrans project team. The disadvantages of changing the contractual terms are that poor contracting practices may result, and Caltrans may waste state resources in using contractual mechanisms that do not suit the work.

D4.3: Develop Partnering Approach

To ensure that the outside consultants work effectively with Caltrans capital outlay support staff in meeting overall project delivery objectives, Caltrans should adopt the approach of developing partnership-like relationships, rather than adversarial relationships, with the outside consultants in the contracting-out program.

The advantages of partnering arrangements are more flexibility for Caltrans in using outside consultants to assist in project delivery, and less expense for both Caltrans and the consulting

community in contract administration. The disadvantages are that partnering arrangements do not necessarily result in lower costs compared to normal contracting-out approaches, and major cultural barriers and perceptions on both sides would have to be overcome to make the approach work.

D4.4: Implement an Early Warning System

To ensure that the consultant and Caltrans are effectively communicating and that the project is proceeding satisfactorily, an early warning system should be established that enables both the consultant and Caltrans to spot problems in the project or contract early. The benefit of this system would be that problems would be spotted early and not remain hidden (e.g., large number of drawing changes should not be identified in late reviews). The disadvantage is that for an early warning system to work, each party must be willing to trust the other and recognize when they are causing the problem.

Recommendations

Despite recent changes in the administration of the contracting out process, we believe that substantial improvements are still required, and we recommend significantly streamlining the contracting-out process and orienting Caltrans more toward managing external professional services efforts.

R51: Reduce Contracting-Out Administration Requirements Substantially

The project delivery environment is constantly evolving and requires frequent adjustments in priorities, resource assignments, schedules, and scope. To use outside consultants effectively in that environment, Caltrans must reduce the time it takes to advertise and award an A&E contract to about 2 months, depending on the complexity of the project. Achieving this reduction requires the following actions:

- Allow Caltrans to issue A&E contracts without obtaining approval by the General Services Department
- Eliminate the involvement of Caltrans headquarters in the contracting-out process (delegate all authority on contractual and commercial issues to the districts)
- Change the practice of conducting pre-award audits on each project and instead conduct only annual, interim, or end-of-project audits
- Ensure that a separate unit in each district is responsible for administering the contracting-out process and the contractual and commercial details of the contracts.

This recommendation is linked to recommendations for increasing Caltrans' contractual options in hiring outside consultants and enhancing efforts to develop partnership-like relationships with the consultants.

R52: Change Contractual Terms

We recommend, through statute and policy changes, that allowances be made in the contractual and commercial conditions for quick agreement and issuance of change orders during

the course of the project, the use of contingencies, the use of fixed billing rates, and the use of performance warranties and guarantees. We also recommend having the option of using fixed-price contracts should the need arise. This recommendation is closely linked to recommendations for experimenting with new project delivery approaches (e.g., design/build contracts, project management only contracts), pushing partnership-like relationships with outside consultants, and training Caltrans' staff and outsiders on project delivery procedures and standards.

R53: Enhance Efforts to Develop Partnership-Like Relationships with Outside Consultants

To reduce the amount of effort needed to supervise outside consultants, reduce the amount of rework and corrections, and tap outside engineers' innovation and creativity in helping Caltrans to meet overall project delivery objectives, Caltrans should enhance its efforts to develop partnership-like relationships, rather than adversarial relationships, with the outside consultants in the contracting-out program. Important first steps in developing those relationships will be to develop the training and guidelines for early and frequent communications between the consultants and the Caltrans counterparts during project delivery. This recommendation is linked to recommendations for increasing Caltrans' contractual options in hiring outside consultants, for reducing the contract administration requirements for outside consultants, for implementing an early warning system for outside consultant contracts, and for experimenting with new project delivery approaches.

R54: Implement an Early Warning System for Contracting-Out Projects

Caltrans should develop an early warning system that enables both the consultant and Caltrans to spot problems in the project and respond quickly. This recommendation is tied closely to the other recommendations to reduce the contract administration requirements associated with contracting out and to enhance the relationships with the outside consultants.

Finding D5: Lack of a Cost-Control Culture

> *Caltrans management does not hold the project manager and functional managers accountable for project delivery support cost performance or have the systems and procedures to provide effective support cost control of projects. As a result, Caltrans does not yet have support-cost control at the individual project levels to achieve its project management and project delivery objectives.*

Over the years, Caltrans had priorities other than controlling support costs in project delivery, and a culture developed that was not cost-conscious. Although this situation is changing, Caltrans still does not give sufficient attention to support costs on a project-to-project basis. Caltrans also does not provide the authority to or hold the project manager accountable for project delivery support cost performance or have the systems and procedures to provide effective cost control of projects. A good example of having other priorities is the fact that the PSR, while giving considerable emphasis to estimating construction costs and project delivery schedule milestones, pays little attention to establishing support cost targets for efficiently completing project delivery. The lack of attention is also a function of the fact that programming documents do not include project support costs.

Examples of inadequate systems and procedures for support cost control are the following:

- PYPSCAN is primarily a tool for resource loading at the macro (program and district) level. However, the PYEs for an individual project only represent an approximate level of effort based on historic norms, and by the time PYPSCAN is used to allocate resources for a project, the formula and data are approximately 2 years old. PYPSCAN also does not include allocations for contingencies or rework. The acceptance of PYPSCAN allocations of PYEs encourages an attitude of "it takes what it takes" rather than an attitude of "what's the most cost-effective approach."
- Functional managers, project managers, and project personnel are not rewarded or punished for support cost savings or overruns. As a result, they lack the incentives to change their behavior.
- Transportation Accounting Management System (TRAMS) cost data and Project Management Control System (PMCS) milestone data are not connected, making it difficult to determine whether expenditures versus accomplishment are on track. In addition, available PYEs are typically used up in the time charging system; when the time charge data are fed back to the PYPSCAN data base, the budgeting of resources becomes a self-fulfilling system.

In the end, project managers and functional managers cannot control support costs without real-time information, and inadequate support cost planning and cost reporting tools leave the project manager in the dark with regard to support cost control on individual projects (see Figure II-10). Our conclusion is that Caltrans does not have support-cost accountability at the individual project levels to achieve its project management and project delivery objectives.

Options

D5.1: Develop a Strong Support-Cost Control Emphasis

To develop a strong support-cost control motivation, and eventually the ability to hold individuals accountable for support-cost spending, Caltrans could take several actions including the following:

- Developing a set of meaningful measures of service efficiency and effectiveness for support costs and construction costs at the project level
- Estimating support costs in the PSR stage
- Including support cost estimates in the STIP
- Creating new linkages between support- and construction-cost performance and personal evaluations and appraisals
- Reviewing the design and procedures for project cost accounting to ensure proper charging of time to EAs, realistic allocation of overhead back to projects, and timely data input and retrieval of information
- Developing a system for providing feedback on construction cost overruns and maintenance costs (e.g., prepare close-out reports on costs at the end of construction).

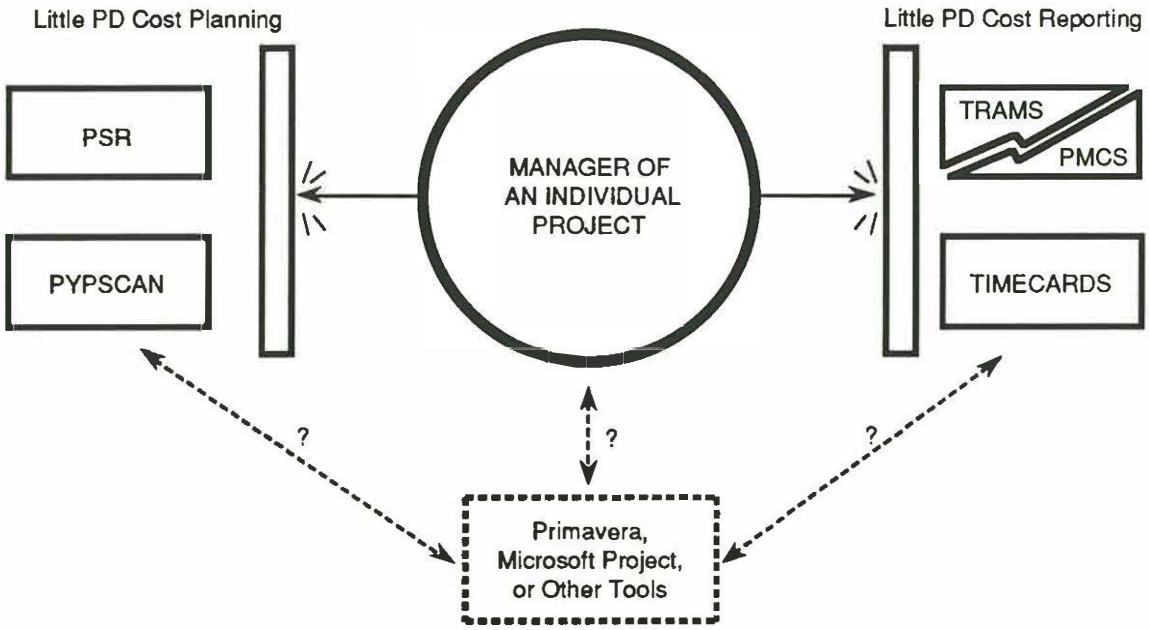

FIGURE II-10 CURRENT SYSTEM OF PROJECT DELIVERY CONTROL

The advantage of implementing these actions would be that Caltrans' project personnel, managers, and administration would develop a strong awareness and motivation to control support costs, which would result in improved support-cost expenditures and ultimately lower costs. The disadvantage of emphasizing support-cost control is that construction costs, maintenance costs, and tort liability costs may rise because weaker designs are passed on to construction.

D5.2: Reward Organizational Units for Support-Cost Savings

To provide incentives to improve resource productivity, Caltrans should eliminate the disincentives for not using all of the outlay support resources allocated. One strategy would be to give project managers and functional managers the authority to redirect some or all of the saved resources. Currently, when resources are saved, they are generally taken away from the manager.

The advantage of this option is that managers would have an incentive to make improvements and obtain the savings, and they would be less inclined to spend all of their allocated resources so they can have the same resources the next year. The disadvantage of this option is that some of the saved resources would not necessarily be spent on priority tasks.

D5.3: Develop Value Engineering Approaches

A long-term option for creating a bottom-line focus within Caltrans and improving the overall effectiveness of spending would be to enhance policies and approaches for value engineering and life-cycle costing in Caltrans. An initial step would be to review current Caltrans' philosophies, practices, and results in these areas and identify potential enhancements.

Recommendations

Caltrans requires a strong focus on support costs. To change the culture at Caltrans and obtain support-cost accountability will require an integrated set of changes in management information systems, senior management leadership, human resources management, and project delivery philosophy. Recommendations in other sections that will affect this culture and accountability include R8, R11, R16, and R38. In addition, other elements need to be implemented.

R55: Develop a Set of Meaningful Measures of Service Efficiency and Effectiveness for Support Costs at the Project Level

By developing a set of meaningful measures of service efficiency and effectiveness for support costs at the project level, Caltrans' project personnel, managers, and administrators would become more aware of and motivated to control support costs. Such a move is designed to lower costs and increase efficiency.

R56: Provide Support Cost Estimates in the PSR

Including support cost estimates in the PSR would increase accountability for these charges.

R57: Review the Design and Procedures for Project Cost Accounting

SRI recommends that Caltrans review the design and procedures for project cost accounting. This would ensure proper charging of time to EAs, realistic allocation of overhead back to projects, and timely data input and retrieval of information to enhance project control.

Finding D6: Matrix Project Management Alternatives

> *Caltrans has a patchwork of project management approaches implemented in its districts. Caltrans districts were delegated the authority to develop their own individual project management strategies based on headquarters' guidelines. Each has its own approach, resulting in a number of suboptimal results. In addition, with responsibility for 5 to 25 projects in various stages of delivery, project managers at Caltrans have little time for the close coordination, expediting, and networking on each project that helps minimize and resolve conflicts.*

Caltrans districts currently use two matrix organizational approaches for deploying project managers in the organization (see Figure II-11). In the "Two Hats" approach, senior engineers or supervisory engineers in the project development units are assigned project manager responsibilities in addition to their functional design responsibilities. To date, the Two Hats approach is the primary approach used by the districts. This approach helps focus powerful functional managers on project management as well as on engineering issues.

In the "Full-time PM" approach, the project managers are in organizational units separate from the functional project development units; these managers focus exclusively on project management responsibilities. The Full-time PM approach helps focus attention on the project management role and responsibilities encouraged by Caltrans' overall commitment to the project

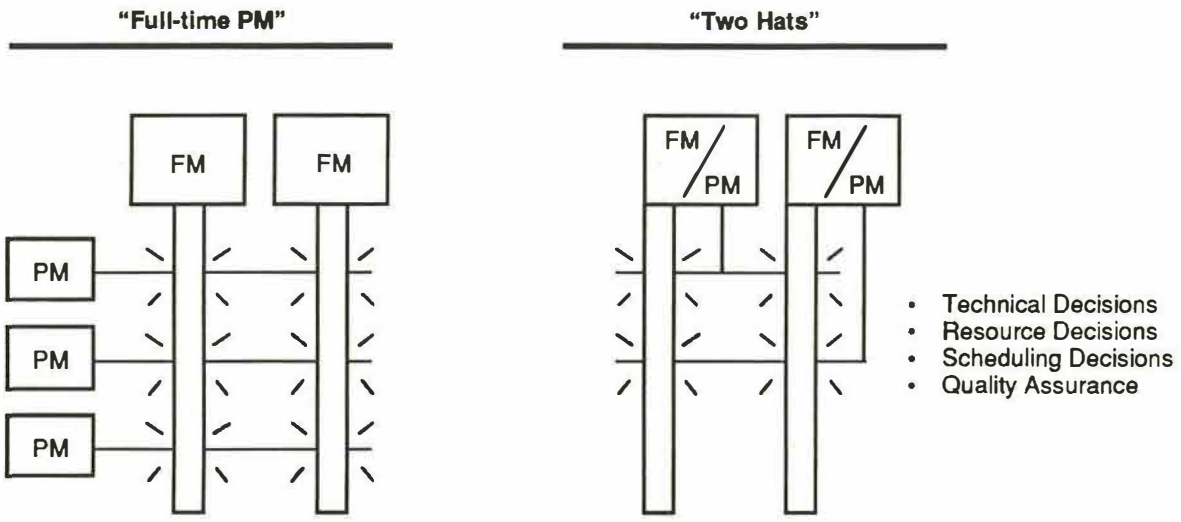

FIGURE II-11 CALTRANS PROJECT MANAGEMENT ORGANIZATIONAL APPROACHES

management concept. On the other hand, the Full-time PM encounters a power base dominated by branch functional managers who generally hold the upper hand in influencing most decisions. Caltrans does not widely use this approach, however.

The biggest issue in regards to the Two Hats approach is that the project manager's duties have been added to a functional engineer's or manager's responsibilities. While the engineering responsibilities involve the project manager thoroughly in the technical issues of a project, accomplishing both project management and engineering responsibilities at the same time is difficult. The Two Hats approach also sets up conflicting priorities with the project managers' own project engineering needs often being served first.

The Full-time PM encounters a power base dominated by branch functional managers who hold the upper hand in influencing most decisions. Full-time project managers who fight hierarchical chiefs to overrule decisions that adversely affect delivery of their projects gain little reward. The result is that the project managers can function only as project coordinators and, like in the Two-Hats approach, the hierarchical structure still dominates.

The Full-time PM position is also perceived more as a rotational assignment from which to return to the "real career path" toward functional branch manager; there is not yet a well-established career path from running small projects to running large ones to supervising the delivery of projects.

Civil service rules and promotion practices limit Caltrans' flexibility to create optimum organizational structures for assigning project managers and structuring the project delivery work. For example, associate-level positions are being eliminated, which means that seniors in functional units that are also project managers cannot delegate their engineering supervisory responsibilities to another person working for them. In addition, while it may be more of a perception than reality, Caltrans personnel believe that seniors, who are assigned to be full-time project managers and do not have engineers directly reporting to them, have less opportunity for advancement.

Caltrans personnel do not agree about whether the "Two-Hats" or "Full-time PM" approach is consistent with Caltrans' project management objectives. In any event, with responsibility for 5 to 25 projects in various stages of delivery, neither the Full-time PM nor the Two-Hats approach gives much time for the close coordination, expediting, and networking on each project that helps minimize and resolve conflicts. When an individual's time is spread across a number of projects at the same time, the percentage of time spent on value-adding tasks drops rapidly, as an increasing fraction of time is spent on non-value-added tasks such as remembering or tracking down information. In addition, the individual becomes the bottleneck on many of the projects to which he or she is assigned. This bottleneck effect holds true for both the project managers and the individuals assigned to the projects.

Options

D6.1: Continue to Use the Two-Hats Project Management Approach

The preceding discussion highlights the advantages and disadvantages of this option.

D6.2: Continue to Use the Full-time PM Approach

The preceding discussion highlights the advantages and disadvantages of this option.

D6.3: Use a Hybrid of the Two-Hats and Full-time PM Approaches

Alternatively, Caltrans could use a hybrid of the Two-Hats and Full-time PM approaches, where the Two-Hats approach is used for smaller, less complex, less sensitive projects and the Full-time PM approach is used for projects requiring the attention of the full-time manager.

The advantage of this option is that the strengths of each approach are used where they fit best. The disadvantage is that it leads to complexity in the overall organization.

D6.4: Reduce Number of Assignments for Individuals at Any One Time to Improve Productivity

Caltrans management could extend efforts to significantly reduce the number of active project assignments that individuals are assigned at any one time. Potential options to address the number of projects to which an individual is assigned include:

- Eliminating situations in which single individuals are assigned more than five active projects or tasks
- Eliminating situations in which Two-Hat managers have more than five projects
- Eliminating the requirement that every project be assigned to a project manager
- Creating "floaters" to be available as needed.

Focusing individual efforts on just a few projects will increase the amount of time spent on value-added activities, improve overall productivity, and accelerate schedules. The disadvantages of reducing active assignments are that long-lead time issues are not addressed and the potential for delay increases.

D6.5: Leave Authority with the Districts

One option would be for Caltrans headquarters to provide guidelines and examples of successful project delivery models, set performance measure targets, and monitor performance, and then let the districts decide how to organize and implement. The districts currently have this authority.

D6.6: Remove Authority From Districts

The other option in deciding on types of matrix organizations would be for headquarters to specify the roles and responsibilities of project delivery functions and the project delivery approach for districts to take, in addition to providing guidance, setting performance targets, and monitoring performance. An important action to take in whatever option is selected would be to define the key roles of functional managers, project managers, deputies, and functional personnel who operate inside Caltrans.

Recommendations

This finding has been addressed by **Recommendation R43**.

Finding D7: Need for Enhanced Project Managers' Skills and Experience

> *With Caltrans' commitment to project management less than 5 years old, few staff members have extensive experience as project managers. As delegation of project responsibilities increases, project managers will become more involved in planning at one end and construction at the other, will work more with external agencies and the community, and will make more decisions on non-highway design issues. Caltrans will need to develop future project managers with the diverse skills, experience, and leadership to effectively carry out their project delivery duties.*

With the Caltrans' commitment to project management less than 5 years old, the current cadre of Caltrans project managers responsible for project delivery is relatively young and inexperienced (see Figure II-12). The new project managers have been largely drawn from a pool of young project development staff at Caltrans. Most do not have management training beyond Caltrans' own Project Management Academy; however, extensive project engineering experience does exist at all levels of the organization, and this experience is readily available.

In general, the project manager tends not to have the stature (image and experience) equivalent to a functional branch manager. In oversight projects, outside contractors are also likely to assign project managers with more experience than their Caltrans counterparts. In addition, few senior project managers are available to act as mentors or role models for the less experienced, newly assigned project managers. For the largest, most complex projects, however, Caltrans will assign senior functional managers or even deputy directors as project managers.

Project managers are only drawn from the project development design functions because much of the work in project delivery involves highway design. Future project managers will require more diverse skills and experience than needed today, however. As delegation of project responsibilities increases, project managers will:

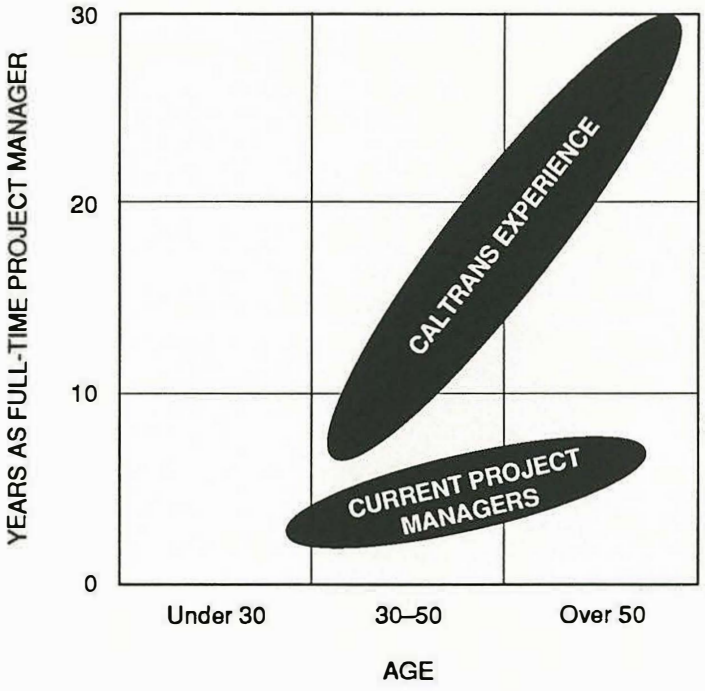

FIGURE II-12 EXPERIENCE PROFILE OF CALTRANS PROJECT MANAGERS

- Become more involved in planning at one end and construction at the other
- Work more with external agencies and the community
- Make more decisions on non-highway design issues.

Given the large number of project managers currently gaining experience, after 2 to 3 more years Caltrans will have a strong human resource foundation for managing projects. The key will be in providing them the exposure, training, technology support, and leadership to learn the proper management techniques and objectives.

Options

D7.1: Develop Pool of Project Managers

Options for ensuring that Caltrans has the right type and number of project managers include:

- Adding training programs early in an engineer's career for needed project management skills such as communications, consensus building, and using schedule and cost tools
- Implementing a program allowing individuals to begin with small projects early in their careers

- Opening up project manager assignments to nonlicensed engineers who demonstrate superior project management skills
- Supplementing existing training programs and policies for oversight projects with guidelines and training modules that emphasize the concept of partnership between Caltrans, the measure authority, and consultants, and early and frequent communication between the parties
- Developing personnel policies and procedures that allow for persons assigned to nontraditional roles to receive the same promotion and career development opportunities as when they work on traditional projects.

Besides producing better prepared managers, the program to improve the training and development of managers would create a larger pool of motivated project managers from which to draw when the need arises. The disadvantages of emphasizing project management skills would be the costs of the program and the diversion of the individuals from developing their functional skills and experience.

D7.2: Train Matrix Managers Together

One option to improve the relationships between project managers and functional managers is to train them together in project delivery. This training would include ongoing skills development in negotiations, communications, and other management skills, as well as selecting actual projects, such as minor A projects, to provide on-the-job experience.

The disadvantage of this training would be the costs associated with the program and removing the managers from their day-to-day operations.

D7.3: Upgrade Project Management Function

Project management assignments require upgrading in terms of their importance and significance to an individual's career. Options to accomplish this include:

- Providing large credit to project management assignments in evaluating candidates for promotion
- Creating project management classifications within civil service categories
- Placing high-potential candidates in key project manager assignments.

The advantage of these options would be that Caltrans would be able to attract the best candidates for the project management assignments and consequently develop them in this field. The disadvantage would be that another advancement ladder is created and functional skills are de-emphasized.

Recommendations

R58: Develop a Pool of Project Managers

To assemble the number and caliber of project managers necessary to perform future project manager functions effectively, Caltrans should:

- Assign substantial credit to project management tasks in evaluating candidates for promotion
- Create project management classifications within civil service categories
- Open project manager assignments to nonlicensed professionals who demonstrate superior project management skills
- Assign high-potential candidates to key project manager positions.

With the advent of new performance measures, project managers will be held responsible for the on-time and on-budget delivery of projects assigned to them. To achieve their objectives, they should, over time, be allowed the flexibility to bid work between internal and external providers to obtain the support they require to meet their objectives.

These recommendations are linked closely to the recommendations for dedicating individuals or organizational units to specific project delivery roles, experimenting with new project delivery approaches, mandating a statewide project delivery approach, creating a strong one-hat project manager position for more complex projects, and implementing a comprehensive project control system at Caltrans.

Finding D8: Need for a Project Delivery Performance Control System

Caltrans currently lacks a system to effectively manage individual projects and functions with groups of projects. Practices vary within the districts, but generally for purposes of managing the project delivery process, targets are not set and monitored for capital outlay support costs and quality. As a result, Caltrans does not have the basis for measuring and improving the productivity of its capital outlay support.

To achieve project management goals and improve the efficiency and effectiveness of project delivery, Caltrans must set project cost, scope, schedule, and quality performance targets and measure performance against those targets. Some measures already exist; for example, outputs of Caltrans' project delivery process currently measured and reported outside of Caltrans are the number of projects delivered and capital costs delivered in each period. Milestone targets are set for these outputs, and actual results are reported by Caltrans to the CTC. In addition, one measure of overall efficiency, the percentage of capital outlay support costs to capital costs for all of Caltrans, is reported each year.

Many important measures do not exist, however. At the project level, practices vary within the districts, but generally for purposes of managing the project development (i.e., engineering) process, targets are not set or monitored for project delivery support costs. As a result, project managers and functional managers cannot be held accountable for the expenditures of support costs. In addition, measures of the effectiveness of Caltrans' project delivery process, such as life-cycle costs for the units delivered, total cycle time to install facilities, or ultimate customer satisfaction with the facilities, are not used.

PYPSCAN provides estimates for project delivery milestones and resource requirements based on statewide historical estimating factors. As noted previously, if PYPSCAN over- or underestimates a resource, then project managers, functional managers, and district management

do not typically negotiate and agree on revised targets. Efforts have just begun to set separate individual project performance targets, but much needs to be done.

Current project delivery measures that are required by state statute and reported to the CTC have had a dramatic influence on Caltrans' management systems and Caltrans' project delivery milestone accomplishment performance. Caltrans personnel at all levels are focused on achieving the milestone objectives. Recent performance for the 1992-93 budget year, as shown in Table II-11, indicates that Caltrans was generally successful in meeting its delivery and construction cost targets given the fact that targets are set through the programming process before final project scope decisions have been reached.

Table II-11
PROJECT DELIVERY SCHEDULE PERFORMANCE FOR STIP, SHOPP, AND TSM

Number of Projects	
Planned delivery for 1992-93	393
Projects delivered in 1992-93 (not including projects delivered early)	350
Percentage of planned projects delivered	89%
Advanced projects from future years	92
Capital Outlay Dollars	
Planned delivery for 1992-93	$2,066 million
Projects delivered in 1992-93 (not including projects delivered early)	$1,912 million
Percentage of planned projects delivered	93%
Advanced projects from future years	$262 million

Several problems still exist with the department-level measures, however:

- External stakeholders do not receive sufficient feedback to know that support costs are being managed effectively or that productivity of the project delivery effort is improving.
- Definitions of what are included in measures required by statute are still being argued and negotiated among Caltrans, CTC, and the legislature.
- Even for schedule milestones and construction costs, current measurement and tracking systems do not allow senior management to spot and take early action on project problems.
- Caltrans or the CTC do not measure project delivery and schedule performance for projects that are not 100% Caltrans (i.e., special funded projects), unless Caltrans is doing reimbursable work for the project. As a result, progress and delivery performance on a significant portion of the state's transportation system is not tracked at the state level.

The Caltrans organization has an excellent reputation for achieving the technical objectives in project design and delivery; staff members want to maintain this reputation. Additional quality measures are being developed by some districts to monitor Caltrans' engineering

effectiveness and efficiency (e.g., construction change order tracking, comparison of the engineer's estimate vs. the bid price, and total supplemental allotment).

Options

D8.1: Develop an Overall Management Approach for Control

For this option, a systematic approach for setting performance measure targets at the project level and function level, measuring against those targets, and taking action would be developed. Key elements of this approach would include an initial project plan and setting of performance targets, developing functional multiyear plans, an early warning system for identifying deviation from the initial plan, monitoring performance against targets, problem identification and resolution, communication of performance to stakeholders, and project handover and closeout.

The major benefit of implementing performance measures is that they help to drive project delivery performance improvement. Whether one is concerned about cost-effectiveness or major milestones, the measures focus attention on the public's goals; linkages among design tasks, schedule, and cost; and the tradeoffs among them. They are also the basis for holding individuals accountable for their actions and rewarding them for good performance. The difficulties in implementing a measurement system include identifying the performance measures for which information can be collected that reflect the overall project delivery goals, and avoiding a system of detail and control that is expensive to maintain, rarely up-to-date, and never used by the decision makers.

The development of an overall performance control system would ensure that the necessary elements are in place to drive performance improvement. It would also demonstrate a level of project delivery performance consciousness. To develop this system, however, would require considerable planning, resources, training, and changes in practices. The actual design needs to be established and would constantly be evolving.

D8.2: Develop More Complete Project Delivery Efficiency and Effectiveness Measures

In this option specific measures would be developed for:

- Project support cost targets for projects in which Caltrans is executing the planning and engineering
- Project quality targets.

These measures would be developed at the state level and would apply across all districts.

This option would fill a major hole in Caltrans project management—having the information to improve the cost-effectiveness of and stakeholders' satisfaction with capital outlay support activities and to hold individuals accountable for those variables. The option would also continue to focus the organization's attention on the need for suitable project management tools. The potential disadvantages are that Caltrans' decision-making processes and organization of project delivery responsibilities and authority may not support the measures selected, and Caltrans' powerful culture may resist and undermine the new organizational norms that are desired. In addition, Caltrans' personnel may require significant training and education before they would be ready for the new measures.

D8.3: Develop Functional Unit Measures

The objectives of this option would be to develop cost-efficiency, cost-effectiveness, schedule, and quality measures for functional units, and to focus management attention and resources on a critical aspect of project delivery at Caltrans—namely, the balancing of resources and delivery of multiple projects by the functional units. This option would be necessary to successfully implement the factory approach to project management.

The benefit of implementing this option is that districts will be able to measure performance and hold functional managers accountable for meeting their multiple project targets. It would also provide the basis for effective negotiations between functional managers and project managers. A weakness of developing new measures for functions would be that those measures would be in addition to the project-level and division-level measures and would add to the complexity of managing Caltrans activities. Another potential problem in implementing this option is that investments in software development may be required because commercial software may not be readily available or easily adapted to Caltrans' circumstances.

D8.4: Develop Feedback System

In this option, additional measures at the department level would not be required, but an independent feedback system would provide the legislature and senior Caltrans management with the assurance that a viable system of measures is in place and that it is positively influencing individual and organizational performance.

The advantage of periodically reviewing the system and procedures for measuring performance instead of providing periodic reports with project level detail is that management and the legislature obtain the information they need for making their decisions instead of detailed reports that are never used. The feedback system also serves to highlight ways to improve the performance measurement process. The disadvantage of developing a feedback system is that these systems often do not spot the problems, they are an additional cost, and developing a corrective action process that satisfies everyone is difficult. In addition, if the feedback system does not leave senior management or the legislature confident that support costs are being effectively managed at the project level, a new reporting requirement may later need to be implemented.

D8.5: Measure Performance for All State Projects

Another need is to develop measures for projects in which Caltrans is not responsible for the project delivery (e.g., special funded projects in which Caltrans plays only an oversight function). All projects should be measured regardless of funding source. One option would be for an independent organization (e.g., CTC or a control agency) to compile and report on performance measures for all state and Transportation Authority projects undertaken in California. Besides measures at the project level, it might also involve tracking performance at the local agency level.

The benefit of this option is that much of the state transportation projects are outside of Caltrans' control and those projects also require improvements in project delivery. It also would provide the basis for making decisions about roles and responsibilities in project delivery in the state. The weakness of this option is that it may be difficult to identify and develop the targets

and measures for which reliable information could be collected. Other issues would be identifying who has the authority to request this information and how the information would be used.

Recommendations

An absolute need at Caltrans is to implement a performance-control system for project delivery. The need involves far more than developing new performance measures for Caltrans; rather, it involves setting performance targets, collecting pertinent performance information about progress against those targets, using that information to monitor and communicate about performance, and taking appropriate management actions.

Recommendation R10 also contributes to this finding.

R59: Develop a Comprehensive Performance Control System

Key elements of this system will be:

- An initial project plan that will outline in detail how the project will be delivered successfully, including:
  - What the work breakdown is
  - Who will be responsible for what
  - What resources will be used
  - When deliverables will be provided
  - What risks are anticipated and the risk management plan
  - What communication will occur with senior management, functional managers, and external stakeholders
  - How change will be managed
- Setting of performance targets that are negotiated and agreed by the functional, project, and division managers
- Developing functional multiyear plans
- An early warning system for identifying deviation from the initial plan
- Monitoring performance against targets
- Problem identification and resolution
- Communication of performance to stakeholders
- Project handover and closeout
- Creating an historical data base
- Performance rewards and punishment.

The development of an overall performance control system will require considerable planning, resources, training, and changes in practices. However, Caltrans must avoid creating a

system of detail and control that is expensive to maintain, rarely up-to-date, and never used by the decision makers.

This recommendation provides the foundation for several other key recommendations, including implementing a long-term delivery planning process and implementing the hybrid project delivery approach.

R60: Develop Support Cost and Quality Project Delivery Measures to Apply Across All Districts

We recommend that Caltrans develop specific internal measures for:

- Project support costs for projects in which Caltrans is executing the planning and engineering
- Project quality targets.

These measures are to be developed at the state level and apply across all districts. They must be given the same emphasis as existing measures for construction costs and schedule delivery. Data bases of actual results are to be established and productivity targets set. Caltrans personnel will require significant training and education before they will be ready for the new measures.

R61: Develop Functional Unit Measures

A critical aspect of project delivery at Caltrans is the balancing of resources and delivery of multiple projects by the functional units. To make the hybrid project delivery approach work, Caltrans should implement project cost-efficiency and -effectiveness measures, schedule measures, and quality measures for functional units.

R62: Institute an Annual Independent Review of Caltrans' Performance Measurement and Accountability System

We recommend that an annual review of the system and procedures for measuring performance be conducted and a report provided to the CTC and the legislature. Additional reporting of project delivery performance data by Caltrans is not warranted. An independent annual report assures the legislature, CTC, the governor's office, and senior Caltrans management that a viable system of measures is in place at Caltrans and that it is positively influencing individual and organizational performance. If after several years little progress has been made in implementing a performance control system or in improving support cost efficiencies, then new reporting to the CTC and legislature should be reconsidered.

R63: Amend CTC Responsibilities and Obtain Legislative Concurrence: Monitor Schedule Delivery Performance for All STIP-Programmed Projects Involving State Funds

At present, the CTC monitors schedule delivery performance for all STIP-programmed projects that Caltrans undertakes. Although such monitoring indicates the timeliness of Caltrans' response, it does not capture the timeliness (or lack thereof) associated with the expenditures of other state monies. To obtain this broader perspective, CTC should monitor all STIP projects involving state funds (regardless of Caltrans' role) to track schedule delivery performance. We

expect that the projects currently monitored would remain a category in any expanded reporting so that no information would be lost and Caltrans' performance monitoring would continue.

Finding D9: Insufficient Project Management Tools

Caltrans' project and functional managers currently lack the necessary information technology tools to enable them to plan, budget, schedule, and obtain timely status information for their projects. Key needs include:

- *One set of tools statewide*
- *Flexibility to fit individual project needs (not all projects require the same detail or structure)*
- *Timely integration with actual progress and capital outlay support cost data*
- *Fit with overall program planning (i.e., PYPSCAN).*

Project delivery planning and scheduling systems available in Caltrans include PMCS, Primavera, Microsoft's Project, and the so-called "black box" developed in District 4. PMCS is insufficient by itself as a project scheduling tool. The "black box" is a stop-gap program to develop generic detailed schedules using PMCS outputs. Up until September 1993, none of the systems could be linked to Caltrans' cost systems so that actual resources could not be compared to budgets or estimates.

At that time, a special system, Data Warehouse Release 1.0, was established to extract data from PMCS, TRAMS, and the Office Engineer Data Base. General project information, schedule dates, PY information, and capital cost information can now be integrated by project and be accessible as information to individual managers. Limited by the data available in the existing systems, Data Warehouse is essentially a reporting system rather than a tool for project planning and scheduling. The system is a stop-gap program until a better, more integrated project control system can be developed. Current plans are to have a permanent system replace TRAMS and PMCS by the middle of 1994.

Scheduling systems are updated manually with actual data occurs. In addition, most of the computerized functional department status systems (e.g., Right of Way, Structures, Office Engineer, Environmental, Project Development) are not linked.

Other than PMCS and TRAMS, the state has no mandatory method for planning, budgeting, and monitoring projects. Data tools are not used for project reporting upwards to district management and headquarters except for the program schedule milestones and construction cost estimates. Capabilities included in Primavera and Microsoft's Project, such as schedule and cost progress reporting, variance analyses, and early warning systems, are effectively not available within existing department systems because of the difficulties in extracting the data from those systems in a timely fashion.

In considering the needs for new tools, Caltrans has focused on project managers. Functional managers also require tools, however, and they currently do not have the necessary ones to manage their function efficiently. As we noted earlier, they need the ability to do capacity planning for their function, determine the sequence of project assignments in their function, and review the status of projects and their impact on the function.

Each district and functional unit has the latitude to develop and implement its own technology approach and system. As a result:

- The choice of project management tools (i.e., Primavera or Microsoft's Project) is currently left up to each district.
- Systems cannot communicate with each other (even branches within districts sometimes use different systems).
- Some districts have nothing beyond PMCS and TRAMS.
- Project managers and functional managers cannot always obtain timely status information automatically—many items must be located and input manually.

Current levels of knowledge and familiarity with project management software in project development are very low. The tasks of acquiring and installing the necessary hardware and software at individual district branches will be difficult because of the state's procurement process and because of the large training and learning-curve requirements. Some in Caltrans believe that senior managers' assigning high priority to the development of new tools will result in significant progress in the current fiscal year.

Given the distance to travel and the many barriers, however, Caltrans is likely 3 to 5 years away from providing project managers the necessary tools to implement Caltrans' evolving project management objectives. Among the key challenges for Caltrans will be the following:

- Significant investments in software development, software, hardware, and training are still needed.
- A strong commitment from headquarters and district management will be required to implement the necessary tools.
- Strong direction by headquarters will be needed to assess the needs, create the proper tools, budget, and coordinate their development.

Caltrans also cannot fully use CADD systems in project delivery, and as a result several potential benefits are still not being received. Areas for improvement include:

- Electronic transfer of CADD drawings. Caltrans' use of electronic transfer has increased from 0% at the end of 1987 to approximately 55% today. Structures' systems cannot communicate with Project Development's systems; CADD drawings are transferred by hard copy (this situation should be remedied if current CADD workstation replacement plans are implemented).
- Standardized plans issued by Caltrans are not fully available on CADD.
- Caltrans' use of CADD in design varies significantly from district to district. Potential exists to increase use of CADD.

Administrative procedures to get updated CADD systems are slow; it will take continual investment for Caltrans to remain abreast of current technology and capabilities.

Options

D9.1: Focus on Current Development Efforts

Caltrans is already pushing ahead with plans for a data base warehouse and a comprehensive project delivery management system. Those plans include developing and implementing the comprehensive system in 1 year for the entire department. In this option, Caltrans would continue with this effort.

The advantage of focusing on the existing effort would be that implementation would be faster, and many of the desired features for managing individual projects would be addressed. The disadvantage could be that the scope of the existing effort might not be broad enough, and certain capabilities and features might not be included that are needed to implement some of the measurement options discussed above.

D9.2: Develop Tools for Function Management

Another option would be to design and implement tools for function management to complement the tools and measures for individual project management. Key objectives for use of the function management tools would be for capacity planning, resource management, budgeting, scheduling task delivery, and function performance measurement.

Functional managers currently do not have the planning tools and timely information to deliver on multiple project assignments every year and be held accountable for their performance. These tools would provide that information and allow those managers to begin refining their planning and control. They would also allow functional managers and project managers to better negotiate use of resources. The disadvantage of this option would be the cost and effort necessary to develop tools that are usable in a wide variety of functions and that are linked to existing management systems.

D9.3: Modify PYPSCAN

Another option would be to modify PYPSCAN to support current project types, services, and management practices. In this option, PYPSCAN would be modified to allow for planning of traditional and nontraditional project roles, more up-front resource spending on projects, and more timely feedback about project costs to the system.

The advantage of this option is that PYPSCAN would become better suited to Caltrans' needs for planning project delivery. The disadvantage is that this tool is an agreed upon mechanism between the legislature and Caltrans for planning projects and supporting capital outlay support budgets, and modifying the tool may require agreement on a new mechanism.

D9.4: Reassess Use of CADD

The evolution of CADD tools and their implementation throughout the public and private sectors will provide important opportunities to improve project control and project delivery cost-effectiveness at Caltrans. This option would require Caltrans to reassess its current use of CADD, review technology developments, and evaluate potential alternatives for using CADD to improve project delivery productivity and effectiveness in the future.

The advantage of this option is that Caltrans has much to gain from improvements in this area and studying the issue would not require too many resources. The disadvantage is that the study would require some internal resources to conduct it and would distract from other priority areas.

Recommendations

As we have already discussed in earlier recommendations, Caltrans needs to (1) push ahead strongly with plans for developing and implementing new project delivery management tools in 1 year for the entire department and (2) embark on a redesign effort for project management MIS. These recommendations are essential for implementing the comprehensive control system and the hybrid project management approach. This effort is described in detail in R23, R34, and R35.

R64: Develop Other Managerial Tools for Functional Capacity Planning, Resource Management, Budgeting, Scheduling, and Performance Measurement

For the hybrid project management approach to work, Caltrans needs to design and implement tools for function management to complement the tools and measures that will be developed for individual project management. These functional management tools will be used for capacity planning, resource management, budgeting, scheduling task delivery, and function performance measurement. These tools will also allow functional managers to receive timely information on the multiple project assignments within their responsibility.

R65: Modify PYPSCAN to Permit Greater Flexibility and Accountability

To have a clear and accepted analytical basis for establishing the size of the capital outlay support budget, PYPSCAN should be modified to better reflect the variability of current project types, services, and management practices at Caltrans. As part of the modifications, more up-front resource spending on projects should be acknowledged, and more timely feedback about project expenditures should be input into the system.

The specific needs for modifying PYPSCAN are tied closely to the recommendations for developing a long-term project delivery plan, developing a management control and accountability system, improving the manpower planning process by increasing top-down and bottom-up integration, instituting a 1-year independent review of Caltrans' performance measurement and accountability system, and MIS systems improvements. SRI selected these combined recommendations over the individual options for Caltrans to continue using the Capital Outlay Support Task Force to address the need for better capital outlay support accountability or for giving the Legislative Analyst responsibility for developing a framework. However, both the Capital Outlay Support Task Force and the Legislative Analyst are likely to be heavily involved in the implementation.

R66: Expand Use of CADD as an Engineering Tool

As an extension of SRI's recommendations for redesigning Caltrans' MIS technology, we recommend that Caltrans reassess its current use of CADD, review technology developments, and evaluate potential alternatives for using CADD to improve project delivery productivity and

effectiveness in the future. This recommendation will require a concerted effort because of the complex forces involved and the decisions to made.

Finding D10: Excessive Bureaucratic Guidelines, Procedures, and Standards

Caltrans' guidelines and procedures create a bureaucratic hierarchy of requirements that can add to the costs and delay in project delivery, particularly when nontraditional projects (and outside parties) are involved.

Each functional area has its own set of guidelines, procedures, and standards that dictate how the staff members handle their portion of each project as the project goes through their area of specialization. The objectives of the guidelines, procedures, and standards are to describe the functional requirements to successfully complete a project, communicate good practices and pass on past learning to the staff, help ensure compliance to state and federal statutes and laws, and minimize Caltrans' exposure to litigation.

Discussions with outside parties as well as internal users indicate that the guidelines and procedures created a hierarchy of requirements that added to the costs and delay in project delivery. Many within Caltrans strongly believe, however, that when properly used, the guidelines, procedures, and standards make the entire project delivery process more efficient and are important mechanisms to capture experience and transfer learning. In addition, many believe that the guidelines and procedures also contain the mechanisms and flexibility to compress schedules or take project delivery risks within the constraints of external requirements.

Caltrans' guidelines, procedures, and standards attempt to provide a detailed set of rules to cover the wide range of circumstances encountered on state transportation projects. This approach carries with it the premise that projects are very similar to each other and successful project delivery is a matter of setting rules and getting them obeyed.

With a comprehensive set of rules, one believes that the details are covered, but in reality they are not. The fact is that transportation projects are very different from each other. Each has its own circumstances, its own local situation, its own delivery requirements. To address a project's details requires judgment and imagination. For Caltrans to improve the cost-effectiveness of project delivery for state transportation projects, individuals will need to take risk and not be saddled with a system of avoiding risk. In the end, other than setting a core set of rules, Caltrans' goal should be to provide a management framework of supervision that is less mechanical and more judgmental.

As indicated in Figure II-13, reviews are completed following large blocks of work rather than as continuous work-in-progress involvement. Each functional area makes its own review comments largely independently against its own guidelines; give-and-take discussion with the project manager or project development sometimes never occurs.

Currently, the office engineer plays the primary role in handing over projects from design to construction. In addition to managing the bidding process, the office engineer makes the final reviews in terms of whether the plans are biddable, constructable, and meet Caltrans' drafting standards.

Throughout the sequence, the project manager is theoretically responsible for the project, but has little authority to take the risk of overlapping parts of the process to speed up the process or override functional standards that may be inappropriate to meeting project needs.

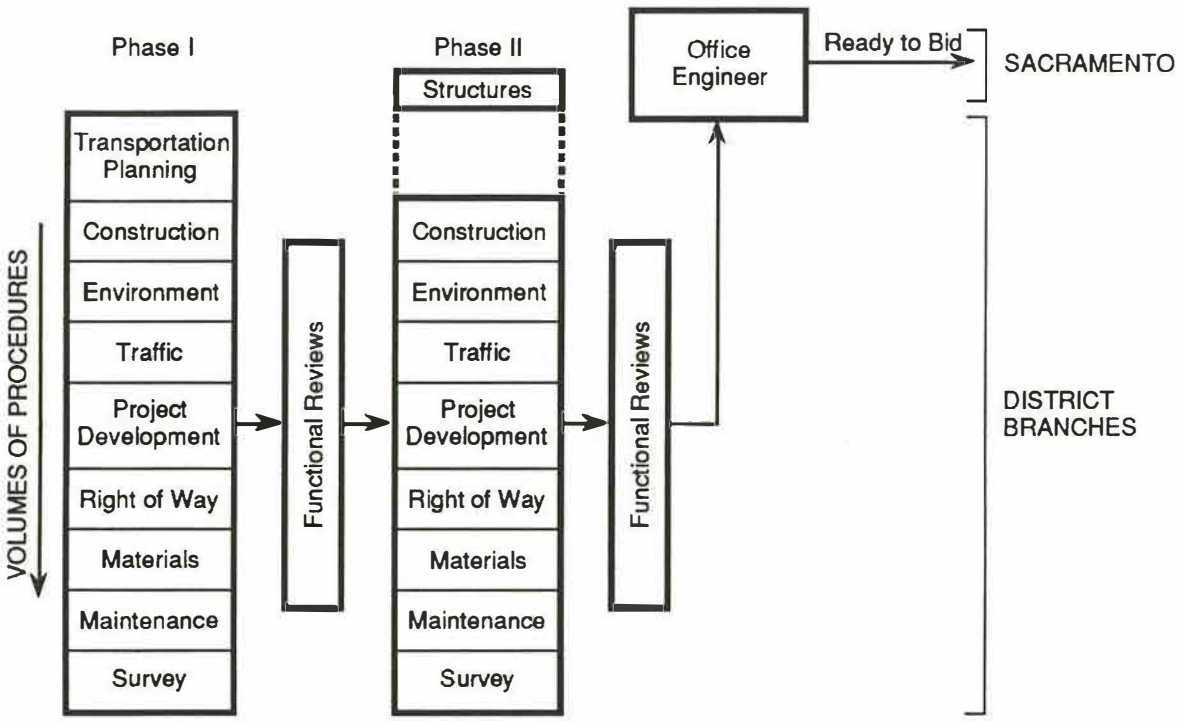

FIGURE II-13 PROJECT DELIVERY ACTIVITY SEQUENCE

Outside contractors, who are required to follow the Caltrans review procedures and sequence, usually lack the power and authority within the Caltrans system to expedite the system. In these circumstances, external consultants cannot easily compress the schedule and take risks. In addition, for county tax measure projects, the oversight work often does not carry the same priority for Caltrans as 100% Caltrans highway projects, and the review periods can stretch out significantly beyond what was planned.

The oversight function requires experienced personnel to work effectively with the outside consultants and county measure authorities, to coordinate all the Caltrans functional reviews, and to ensure that state transportation standards are incorporated. As was noted previously, however, Caltrans' project development staff is relatively young and inexperienced in overseeing the work of outsiders; experienced personnel who are available are not always assigned to oversight projects. In addition, most districts do not have special units dedicated to oversight work. As a result, project development staff working on 100% Caltrans work are also assigned oversight responsibilities. The result has been a number of disputes over standards and project delivery delays. Management attention and a new Oversight Academy has been started at Caltrans to address many of these problems, but much more needs to be done in the future.

Options

D10.1: Emphasize Training of Caltrans and Outsiders

In this option, Caltrans would emphasize training of its personnel and outsiders on the effective use of the guidelines, procedures, and standards. The benefit of this would be improved

knowledge of the flexibility within the guidelines, procedures, and standards, and of the information contained in them to make project delivery more efficient. The disadvantage would be the costs associated with the training and the diversion from other tasks.

D10.2: Review Guidelines and Procedures for Reviewing Outside Consultants' Work

Caltrans' reviews of outside consultants' work are perceived to be overly strict, too numerous, and focused on process rather than results. In this option, a peer review panel with outside participants would review Caltrans' procedures, guidelines, and practices for conducting reviews of outside consultants' work.

The benefit of this option could be a revised set of review guidelines and procedures that reduce the amount of time and cost involved in conducting the reviews and making the necessary changes. In addition, the review would likely lead to better understanding between the consultants and Caltrans on what problems the other faces. The disadvantage would be the cost of this effort and making any of the changes recommended by the peer panel.

D10.3: Investigate Mechanisms for Reducing the Schedule Impact of the Right-of-Way Process

The right-of-way (ROW) process frequently drives the project delivery schedule. In this option, Caltrans personnel (project managers, legal, ROW, others) and outside consultants would form a task force to investigate alternatives for reducing the schedule impact of the ROW process. This task force would start with the results of recent studies and efforts to reduce the ROW procedure manuals.

The benefit of conducting this study is that since the ROW is often on the critical path of project delivery, any improvement will enhance schedule delivery performance. The disadvantage of conducting a study in this area is the cost of the study and the fact that this area has been studied several times recently.

D10.4: Investigate Reducing Caltrans' Oversight Responsibilities and Delegating More Responsibilities to Consultants

A task force would be formed to investigate increasing private consultants' responsibilities for ensuring that their designs and plans meet state standards, and are biddable and buildable. Illinois has significantly reduced the state DOT's oversight function by mandating that private consultants implement rigorous QA/QC programs and be responsible for paying for their own errors and omissions. The task force would investigate ways to substantially reduce Caltrans' oversight functions and responsibilities, pass responsibility for tort liability to the counties, and increase the consultants' QA/QC capabilities.

The advantages of this option would be the reduction in Caltrans resources involved in oversight that can then be used on other project delivery priorities, and the improved project delivery schedules as a result of a level of reviews being substantially eliminated. The disadvantages of this option would be the potential rise in construction and tort liability costs because of errors and omissions by the outside consultants. The outside consultants also might not be able to resolve potential internal conflicts between cost, schedule, and standards. Counties would also likely resist being held responsible for tort liabilities involving state highways.

Recommendations

SRI recommends that Caltrans set targets for reducing the amount of control and procedures involved in project delivery, particularly with respect to contracting-out administration, right-of-way procedures, and Caltrans' oversight of design efforts by others.

R67: Train Caltrans' Staff and Outsiders on Project Delivery Procedures and Standards

We recommend that Caltrans expand its efforts to train Caltrans staff and consultants on the effective use of Caltrans' guidelines, procedures, and standards. The improved knowledge of the flexibility within the guidelines, procedures, and standards that will result from this training will allow project personnel to expedite delivery of the work and avoid costly mistakes.

R68: Simplify Guidelines and Procedures for Administrating Work Contracted Out

We recommend that a peer review panel with outside participants be formed to review Caltrans' procedures, guidelines, and practices for managing outside consultants' work, and recommend actions to improve the process. Issues that we believe should be addressed in that review include:

- Which reviews provide consistent value-added?
- How can consultant QA/QC procedures be enhanced to reduce the type, depth, and number of reviews by Caltrans?
- Does the scope of reviews overlap?
- Does the level of authority match the reviewers' responsibilities?
- Is there an effective mechanism for agreeing on the review changes?
- What would be useful measures for evaluating the effectiveness of the reviews?
- Does the experience of the reviewers fit with the requirements?

This recommendation is tied closely to the recommendation to develop a partnership-like relationship with the outside consultants.

R69: Investigate Mechanisms for Reducing Schedule Impact of Right of Way

We recommend that a task force be formed and charged with significantly reducing the time it takes to complete the ROW process. The goal we recommend is to reduce the time necessary by at least 50%. This task force will build on the results of recent studies and efforts to reduce the ROW procedure manuals. The task force should be composed of Caltrans personnel (project managers, legal, ROW, others) and outside consultants. Issues to be addressed by the task force include:

- How can we significantly simplify Caltrans' process consistent with the federal Uniform Relocation Act?
- What arrangements can be made with major utilities to expedite the process?
- What additional detailed design and integration with other functional units could be completed early to expedite the ROW process?

R70: Increase Consultant Participation and Streamline Oversight

For Caltrans' oversight work, SRI recommends that a task force be formed to investigate increasing private consultants' responsibilities for ensuring that their designs and plans meet state standards, and are biddable and buildable, and streamlining the guidelines and procedures associated with the oversight. A major goal of the task force will be to reduce Caltrans' oversight functions and responsibilities and transfer much of the QA/QC responsibilities to the private consultants. We expect that a significant reduction in Caltrans' resources involved in oversight can be achieved and that those resources can then be used on other project delivery priorities. We also believe that project delivery schedules will improve as a result of a level of reviews being substantially eliminated.

Finding D11: Weak Link between Project Startup and Completion Responsibilities

Strong linkages between project delivery and planning (upstream) and project delivery and construction (downstream) are encouraged in theory but are weak in practice. Project managers tend to be assigned projects as they "come over the fence" and tend to pass on projects "over the fence" to construction.

The project managers' workload is dominated by their project delivery responsibilities, leaving little time or priority for upstream or downstream involvement. Project managers tend to be assigned projects as they "come over the fence" and tend to pass on projects "over the fence" to construction. With gaps in the process, some things "fall between the cracks." Unresolved issues and problems get passed along for the next unit to worry about. Figure II-14 highlights the theory of strong linkages between the areas and actual practice.

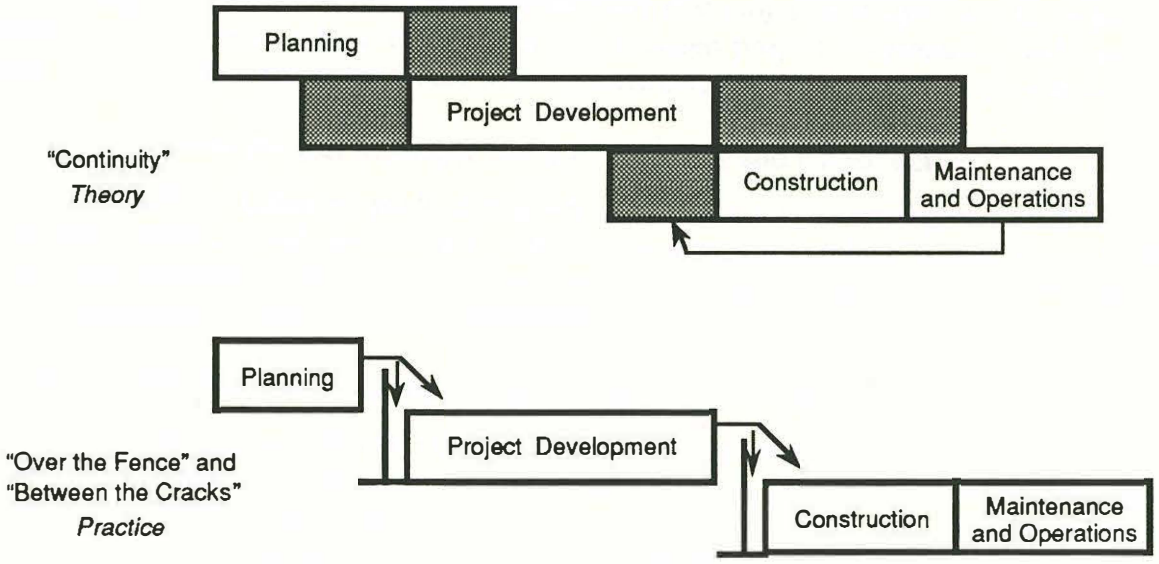

FIGURE II-14 KEY LINKAGES IN PROJECT DELIVERY

There are several reasons for current practices. First, project managers in Caltrans do not have responsibility yet for a project from inception (PSR stage) to completion (handover to maintenance and operations). Second, the policy of rotational assignments for staff makes

Recommendations

Caltrans needs to challenge the traditional cultural barriers between project development, construction, and maintenance that are limiting Caltrans' ability to manage projects and respond to problems effectively.

R71: Link Project Start-Up and Completion Responsibilities by Clarifying Roles in Planning, Project Development, and Construction

SRI recommends that Caltrans enhance its efforts to link planning, project delivery, and construction by defining the responsibilities of each of the parties involved from the PSR stage through construction. This recommendation was selected over the requirement to assign the project manager responsibility for all aspects of each project. For less complex projects, there will not be a project manager with the experience and authority to be held responsible for all parts of the project. The objective therefore will be to have a smooth transition between stages. For complex projects, however, the project manager should have oversight responsibility for all elements so that project conflicts are reduced between planning and project development and between project development and construction, more project delivery approaches can be considered (e.g., design and build approaches), and rework and duplication are lessened.

R72: Develop a Shared Responsibility within Functions for Project Delivery

Significant cultural barriers exist between the major functional areas of project development, construction, and maintenance. SRI recommends that Caltrans create a program of awareness and communication that brings representatives from planning, project development, construction, and maintenance together frequently to explore each other's needs, norms, and assumptions, and develop a shared responsibility for project delivery. This program should occur at all levels of the organization.

IMPLEMENTATION PLAN

OVERVIEW

In this section, we present the highest priority recommendations, the entity responsible for implementing them, the estimated necessary resources, and a tentative implementation schedule.

Because the legislature established this evaluation through adoption of SCR72, the logical leads for initiating follow-up activity are the senate and assembly transportation committees. We anticipate that these committees will review and endorse the evaluation, resultant recommendations, and action plan with modifications as appropriate. From this initial action will cascade a series of subsequent steps for these same committees and other entities as described herein.

We recognize, however, that a series of one-time actions will not produce the necessary improvements. Monitoring and follow-up reporting procedures are required to maintain the momentum for change and to sustain implementation efforts over many years. If such procedures are not established, the benefits to the state of a more flexible, cost-conscious, and responsive Caltrans will be lost. These procedures are also described in this section.

Finally, we have developed recommendations that can be implemented. If after a reasonable opportunity for implementation (2 years and certainly not more than 3 years) the forces in Caltrans resisting change remain unresponsive to the recommendations that the legislature has endorsed (as happened with prior management audits), then we believe that additional study will provide no further benefit. We therefore recommend that, at this juncture, the state governmental agencies with oversight responsibilities seek to restructure (reengineer) the department's procedures to minimize state involvement and maximize private-sector participation in highway design, operation, construction, and maintenance to provide the citizens of California with the efficiencies and accountabilities that they have the right to expect.

CRITERIA DEVELOPMENT

To screen and categorize the options, we first established a set of criteria on the basis of two sources—the circumstances we observed during the evaluation and the SRI project team's own experience and theoretical knowledge. For the first source, we relied on our understanding of issues and stakeholder needs as we observed them in the field and, if verifiable, as they were reported to us. These observations and insights indicate how Caltrans' actions facilitate or frustrate the desires of others, and they help us identify priority needs as well as issues that Caltrans may not have the authority to address. The second source reflects our experience and expertise gained through related assignments for public- and private-sector clients, as well as our knowledge of the literature and theory of organizational change. We have witnessed both effective and ineffective responses to problems in diverse business environments; from this extensive experience we have developed a set of standards that we believe are achievable and that characterize good business practice. The criteria we have used to rate alternative options are summarized in Table 12.

Table 12
SCREENING CRITERIA
(In Order of Importance)

Enhanced Efficiency	Increased output or productivity at equal or reduced cost
Enhanced Effectiveness	Improvements in producing or obtaining desired results
Strengthened Leadership	Enhanced state and Caltrans ability to address transportation issues in the near and long term
Accountability	Timely assessment of individuals, organizational units, and programs
Responsiveness of Stakeholders	Enhanced service delivery; stakeholder expectations changed at a deliberate pace

The first criterion seeks to instill an improved cost-consciousness within Caltrans, measured as greater benefits for each dollar spent. We define efficiency as improvements to current operations that lead to increased output or productivity at equal or reduced cost. Costs can be measured as time, money, and/or hours of staff effort. Enhanced efficiency is demonstrated by more work being done with the same or reduced resources. Caltrans' program and budget responsibilities in the present era of fiscal constraints demand attention to cost efficiency if public confidence is to be maintained.

The second criterion is enhanced effectiveness, signified by improvements in producing or obtaining desired results from an activity or effort. Enhanced effectiveness is demonstrated by a greater ability to "get the job done." Meeting this criterion will require rethinking processes and reorienting efforts whenever feasible, moving from following rules and regulations to productive efforts toward achieving the desired result.

The third criterion stresses leadership both from appropriate state agencies with policy-setting responsibilities and from Caltrans. Our efforts are geared not only to making Caltrans more efficient but also to improving the delivery of transportation services in general. Such improvement cannot be produced by Caltrans acting alone but rather requires the congruent efforts of several government entities, including the legislature and the executive branch. Within its sphere of influence, however, Caltrans can provide leadership in its role as steward of California's transportation resources and through its responsible use of public funds. Leadership will be strengthened at Caltrans if ambiguities about its roles and responsibilities can be removed and if staff can be better motivated to achieve goals.

The fourth criterion focuses on increasing the accountability of individuals, organizational units, and programs at Caltrans. Accountability can take many forms (managerial, fiscal, legal, social, environmental); our primary emphasis is on managerial accountability, which is more enduringly implemented if rewards and punishments—applied in a timely manner—can be used to motivate performance. Improved accountability is expected from Caltrans.

The fifth criterion stresses Caltrans' improved responsiveness to stakeholders (external as well as internal) through honoring its commitments in a more timely manner. Responsiveness to a multitude of parties is implied, including policy-setting agencies, local and regional agencies, special interest groups, employees, taxpayers, and the traveling public. Note that responsiveness is not synonymous with agreement. As an example, Caltrans will require more flexible use of staffing to enhance project delivery. In this case, responsiveness implies that changes (if needed) be introduced over a time frame that still honors commitments; it does not imply that change must be avoided. Fewer delays for internal (process-related) reasons and enhanced service delivery would be characteristics of improved responsiveness.

HIGH-PRIORITY IMPLEMENTATION ACTIONS

From the comprehensive set of recommendations that SRI has presented, we have identified a core set of high-priority recommendations to implement; these are identified in Table 13. Two objectives drove our selection of this set of high-priority recommendations:

1. Implementation of the recommendation must address the most fundamental of Caltrans' problems while yielding the greatest benefits in time and funds
2. Implementation can be accomplished within 2 years from date of adoption.

Our high-priority implementation actions fall into three categories—constitutional change, legislative/executive change, and administrative change—depending on the institutional source of that change (not on priority within the 14). For example, one of our implementation items—to seek a constitutional amendment for contracting out—requires constitutional change. Other recommended actions are expected to require both enabling legislation and cooperation from the governor's office. Finally, many of our recommended steps are administrative actions within the statutory scope of Caltrans, though some of these may also require support from the governor's office or the legislature. Collectively, if implemented, these priority recommendations provide an integrated set of actions to improve Caltrans' management practices.

As previously described, we seek a change from current Caltrans' practice in a number of key areas and thus recommend a series of mutually reinforcing changes designed to enhance the department's efficiency and effectiveness through strengthened accountability and competition. We recommend strengthening executive branch leadership in transportation by refocusing BT&H on its transportation-oriented departments. We recommend that a consistent set of departmental, functional unit, project, and individual staff performance goals (expressing quantitative and nonquantitative targets) be established and that annual performance appraisals (leading to rewards and disciplinary actions) be based on accomplishments relative to these goals. We recommend a contracting-out amendment to enhance competition for internal units. We identify the need for change and recommend MIS improvements to support overall department management and specific functional needs, as well as the performance appraisal process. We recommend expanding the CTP process to address a number of key issues (including long-term funding needs, the appropriate balance of capacity expansion/rehabilitation/maintenance expenditures, and the role of Caltrans in urban and intercity transit) on a continuing basis. Finally, we recommend a series of changes related to project delivery, the most immediate of which include changes in the project approval and permitting processes, development of a hybrid project management system, and creation of a project delivery performance management control system.

Table 13
HIGH-PRIORITY IMPLEMENTATION STEPS

Action to Be Taken	Key Responsible Organization	Support Organizations	Internal Resources	Duration
Constitutional Amendment				
• Remove impediments to contracting out	Legislature	Governor's Office	minor	12 months
Legislative/Executive Level				
• Restructure BT&H to focus on Transportation	Governor's office	Legislature	minor	6 months
• Expand the California Transportation Plan process	CTC	Legislature	2-3 person months	6 months
• Evaluate long-term transportation funding requirements	Governor's office/ Legislature	CTC/Caltrans	4 person years	2 years
• Include capital outlay support cost estimates in the STIP	Legislature	CTC	minor	continuing
Caltrans				
Management, Leadership and Human Resources				
• Enhance efficiency and effectiveness through the following:				
– Develop and implement performance measures	Caltrans	Legislature/CTC	40 person years	2 years
– Develop monetary and nonmonetary rewards and disciplinary actions	Caltrans	Legislature	10 person years	2 years
• Develop a viable implementation plan for mission/values/goals statement	Caltrans	N/A	2 person years	6 months
Management Information Systems				
• Support reengineering of the project delivery/project management processes	Caltrans	N/A	12 person years	18 months
• Continue with interim enhancements, such as the Data Warehouse, as appropriate	Caltrans	N/A	present level	2 years
• Create a new systems development environment and upgrade skills	Caltrans	Governor's Office/ Legislature	20 person years	2 years
Project Delivery				
• Simplify project approval and permit processes	Caltrans	Governor's Office/ Legislature	24-32 person years	2 years
• Implement hybrid project management approach	Caltrans	N/A		
• Develop a project delivery performance management control system	Caltrans	N/A		

The first key recommendation is for more contracting-out flexibility; we believe that a final settlement of the contracting-out issue will require an amendment to the Constitution of the State of California and is unlikely to be achieved by further litigation or legislation. SB1209 was enacted in September 1993 with provisions specifically applicable to contracts for certain projects to support state transportation infrastructure funded by local resources, to retrofit highway structures in accordance with statutes enacted following the 1989 Loma Prieta earthquake, and to ensure timely and cost-effective project delivery. Because of present litigation, pending court decisions, and appeals, however, a stay on contracting out could run for at least another year, and contracting-out prohibitions could remain.

We recommend that legislative action be the source of a ballot proposition required to enact a constitutional change if this issue is to be addressed in a timely manner. Specific provisions of Article VII related to the integrity (and work load) of the civil service need to be recast in a manner that allows competition to enhance efficiency. We recommend that the merits of such a change be considered by the senate and assembly constitutional amendment committees and that wording be developed for an amendment to be proposed to the full legislature. Gubernatorial backing should also be sought.

Our second key recommendation is that BT&H be restructured to acknowledge the overwhelming importance of transportation-related activities under its mandate and the need for better transportation policy direction. Planning for this step, which may benefit from legislative concurrence, is likely to begin in the governor's office. We recommend that the governor's office initiate a review of the purposes and activities of the departments within BT&H and their potential fit into other agencies. Our review indicates that the number and diversity of departments within the agency can be reduced to better focus it on transportation-related issues and policy. We recommend that the findings of this review be incorporated into the follow-up reporting on action taken to implement findings of this audit.

Our third and fourth key recommendations are that the legislature extend the provisions of SB1435 in fulfillment of requirements of ISTEA to establish a transportation planning process to generate the CTP on an ongoing (annual or biennial) basis. We recommend that the legislature seek advice from the CTC as to the requirements for the CTP and that the CTC be tasked with reviewing and commenting on the CTP upon its (annual) completion. Caltrans staff would be primarily responsible for developing the CTP. We further recommend that the Legislative Transportation Committees hold hearings on the planning process as a means of refining the authorizing legislation. We suggest that the plan include elements for local participation through hearings and meetings, and that provisions for statewide working groups to support legislative and Caltrans efforts to address selected themes on a multiyear basis also be included. (Examples of issues that currently require attention include evaluating long-term funding requirements, evaluating the appropriate balance of Capacity Expansion/ Rehabilitation/Maintenance funding, and identification of roles for Caltrans in Local Mass Transit and Intercity Rail. Our findings emphasize the need to address the first issue in particular.)

The 2- to 3-person months of resources and 6-month duration identified for expanding the CTP includes the Caltrans' staff effort needed to support redefinition of the process, including coordination with the agency/governor's office, legislative committees, and the CTC. The recurring resources required on an annual basis will depend on the level of public involvement determined to be appropriate as part of the CTP expansion; we have elsewhere recommended this

involvement to be significant. The 4 person-year and 2 calendar-year estimate of resources to support the evaluation of long-term funding requirements is a provisional estimate of what this specific element of the CTP would require if addressed over a 2-year period. The actual Caltrans resources required will be determined by the analytic and public input requirements of this CTP element, which is to be defined as part of the preceding recommendation.

Our fifth key recommendation is for the legislature to require that capital outlay support costs be included in the STIP. These would supplement the capital outlay estimates and provide a more comprehensive forecast of individual project costs. Providing this information will help establish a data base for tracking improvements in Caltrans' project delivery efforts over time.

The first two management, leadership, and human resource actions we recommend are (taken together) the single most important change we seek. The establishment of group and individual goals, and the rewarding or disciplining of groups based on their ability to meet these goals, is the only effective means available to instill a sense of accountability and timeliness throughout the department. Previous efforts to establish specific goals (such as the establishment of project delivery cost targets) have only frustrated legislators and others with the minimal compliance of the response. Implementation of this key recommendation will require action on several fronts, including:

- Development of a new set of Caltrans performance measures to be used by the legislature and governor's office in evaluating the performance of the department and its management
- Development of an integrated set of division, functional, project, and individual performance measures and goals that improve accountability through reflecting and reenforcing the department's overall performance measures
- Development of personnel procedures that give management the ability to award or discipline employees in a timely manner based on their performance relative to their goals.

We recommend that a set of integrated measures be developed by the governor's office and legislature to establish performance goals for Caltrans' management team and key organizational units; all other sub-measures, such as project-delivery targets and overhead ratios, should be eliminated as separate legislation and incorporated into the integrated departmental measures, as appropriate—as should accounting of capital outlay support. Care is needed to avoid low-level, single-purpose measures, however, as these become "micro-management" of Caltrans, thereby undermining management authority and responsibility for meeting any of the performance goals established.

We also believe that once measurement standards are in place, accountability is critical to break the reaction of "just another plan" that too frequently frustrates implementation of new initiatives. Efforts to measure performance and to obtain accountability will have no impact without implementation of our recommendation to genuinely reward high performing managers and staff, and to discipline those who fail to accomplish their objectives. Toward this end, we recommend that legislation regarding current personnel procedures be revised. Specifically, DPA laws related to MSA, MSA denial, and employee disciplinary proceedings should be reviewed with the goal of maintaining due process, yet permitting more timely and effective management actions to be taken than is presently allowable. Further, we recommend that

procedures that apply to employment and promotion be reviewed to determine if the principles of merit and open competition can be maintained while reducing the barriers that they have created to selecting and promoting employees in a timely manner commensurate with program goals and needs. Examples of procedures to review include position and examination prerequisites, examination content, examination scoring and ranking, veterans preference, and priority consideration to affirmative action groups.

We believe that the development and implementation of performance measures, coupled with new, reinforcing reward and disciplinary procedures will be at least a 2-year process. We believe that a department-wide task force of approximately 10 full-time persons will be needed to run the process, and that they will require an approximately equal amount of time from numerous others on a part-time basis. This task force needs to develop measures that can be monitored over time at the department level and to work with Caltrans management to have these reviewed and adopted by the governor's office and the legislature. Once in place, these high-level measures need to be disaggregated into consistent division, functional unit, project, and individual goals. (Clearly, some thought should be given to this second step as alternative department-wide measures are being evaluated.) The estimate for measure changes includes some time for evaluation of changes to position descriptions and promotional requirements. Implementation of these changes also needs to be pursued and will likely require at least 5 PYs each year for a 2-year period.

Our eighth recommendation arises from the need to implement the director's mission, values, and goals statements. We have found that planning—which focuses on multiyear policies and strategies as well as on implementation of the director's mission, values, and goals—is sorely needed. An implementation plan for the director's statements is needed to translate expressions of the organization's vision into concrete, measurable steps. By its second year, this implementation plan should incorporate performance measures developed jointly by the governor's office, the legislature, CTC, and Caltrans, as discussed above.

New management information systems will be necessary to implement our recommendations. Other recommendations should lead Caltrans management to rethink the department's basic business processes (particularly in the area of project delivery); they can then begin an effort to reengineer the business process and, as part of these actions, to redesign the related data systems to fit and support the reengineered business processes. This systems redesign element of the project delivery reengineering effort is our ninth key recommendation.

The redesign of the MIS in support of reengineering the project delivery process is estimated to require 12 PYs over 18 months as a one-time effort. We believe that an eight-person DIS team participating in the reengineering process will be able to fully identify the changes required by DIS. The level of effort required for implementation of the MIS changes will depend on the findings of this working group as regards procedural changes and hardware/software requirements.

Our tenth key recommendation endorses Caltrans' efforts to enhance the links between individual system islands by developing data bases at a new level. The Data Warehouse is the first example of this new data base level. The initial Data Warehouse contains general information about projects and project-related PY and capital costs and is automatically updated as other data bases are changed. Although we support DIS efforts, we view these as interim

efforts that should be abandoned when data systems in a functional area (such as project delivery) are redesigned as part of a broader business processes reengineering effort.

From the standpoint of continuity, in our MIS-related series of recommendations, we recommend carrying forward improvements to the existing development environment and the systems that DIS supports. From the standpoint of a new beginning, in the long term we believe that the existing systems and the development environment must be redesigned to take full advantage of emerging information systems technologies, such as powerful and inexpensive microprocessors, CD ROM, and image processing. An integral part of this process will be enhancing staff skills in those areas where new system developments are occurring.

Creation of a new systems development environment will result in an ongoing process of renewal that requires constant evaluation and development of new tools and techniques and dissemination of the resulting information gained through the department. At least in the first year or two, we envision that an effort of 10 PYs annually will be required to assess the future role of mainframe systems at Caltrans. Following this assessment, the recurring annual investments in hardware, software, and training will depend on the system environment adopted. To implement our recommendations of improved performance measurement, we have previously identified internal resources required, some of whom will be drawn from DIS staff.

Finally, we recommend that the project delivery process be structurally overhauled (reengineered) to reduce the long time frames and extensive amount of rework associated with current projects. Significant cost savings are possible by reducing the time required to deliver projects and eliminating unnecessary steps and rework associated with the current design, approval, and permitting processes. To accomplish this, we recommend the following objectives:

- Integrate project delivery considerations explicitly into the overall strategy planning of Caltrans
- Streamline and simplify the involvement of regulatory agencies and other stakeholders in project planning, early project development, and permitting processes
- For complex projects, give the project manager more authority and make that individual more in charge of and accountable for project delivery results; with more numerous, less-complex projects, emphasize the role of the functional manager and make that function more responsible and accountable for project delivery results
- Develop and implement a comprehensive performance management system for planning, measuring, and controlling projects, including specific targets, measures, and accountability mechanisms for project delivery support costs; provide support cost estimates in the project study reports (PSRs); and include support cost estimates in the STIP (as previously recommended)
- Attack bureaucratic barriers in the administration of external contracts, oversight of external consultants, and right-of-way activities.

Eleven specific actions to include in the reengineering of the project delivery process are as follows:

1. Develop a long-term project delivery plan, which would integrate delivery requirements for all projects and balance resource and priority needs for at least the next 5 years. Key outputs of the plan would be intermediate project delivery goals and objectives for districts and functions within districts, including multiyear budgets
2. Establish a multi-stakeholder task force to rationalize the project approval and permit processes and obtain earlier stakeholder involvement and commitment. The task force would be charged with reducing the bottlenecks, eliminating the potential for rework, and developing mutually acceptable project solutions. The goal of the task force would be to obtain the commitment of external agencies and special interest groups to buy-in or object to projects at the planning stage rather than questioning basic assumptions or challenging a project during the design phase. State and federal agencies would also commit to timely review and issuing of permits or forfeit the opportunity to regulate.
3. Assign project managers authority and responsibility for resources on a project, including functional personnel assignments on complex projects. For less-complex projects, reassert the functional managers' authority and responsibility for achieving project delivery goals and create a project coordinator function to shepherd projects through the system
4. Develop a comprehensive performance control system that includes:
   - Modifications to PYPSCAN to permit greater flexibility and accountability
   - Requirements for initial project plans with detailed schedules and performance targets
   - Functional unit multiyear plans for all projects
   - A performance monitoring system for examining performance against targets, including an early warning system for identifying deviation from plans
   - A problem resolution process
   - Project handover and closeout methods
   - Performance rewards and punishment process
5. Create a set of measures for service efficiency and support cost effectiveness at the project level. Provide support cost estimates in the PSRs and include support cost estimates in the STIP
6. Develop functional unit measures and information management tools for functional managers and hold them accountable for cost-efficiency, cost-effectiveness, schedule, and quality
7. Institute an annual independent review of Caltrans' performance measurement and accountability system and provide a report to the CTC and the legislature.

Additional reporting of project delivery performance data by Caltrans is not warranted

8. Assign total responsibility for administration of the contracting-out process to the districts and eliminate the involvement of Caltrans' head-quarters, the involvement of the General Services Department, and the use of pre-award audits

9 Form a task force and charge it with significantly reducing (by at least 50%) the time needed to complete the ROW process

10. Form another task force to increase private consultants' responsibilities for ensuring that their designs and plans meet state standards and are biddable and buildable and to streamline the guidelines and procedures associated with Caltrans' oversight. A major goal of the task force will be to reduce Caltrans' oversight functions and responsibilities and transfer much of the QA/QC responsibilities to the private consultants

11. Experiment with alternate contracting approaches for the variety of project types with which Caltrans is involved. Those approaches include the use of design-and-build contracts for complex, urgent projects; project management only contracts for large, complex projects; lump-sum contracts for engineering; and new partnership arrangements with the private sector. The results of these experiments should be documented and used to develop Caltrans' options for cost-effectively delivering projects.

We anticipate that the focal point for restructuring the project delivery process will initially need to be a team of approximately 12 persons assigned full time for a period of at least 2 years. This would need to be supplemented by others involved on a part-time basis. This team would be supplemented by the eight-person team from DIS, identified above, and would address issues overlapping those being evaluated by the ten-person task force evaluating new performance measures. This effort would likely require more than 2 calendar years to complete, but subsequent levels of effort will be dependent on the direction taken by the teams and the extent to which unanimity of direction emerges in their early efforts. We anticipate that these implementation efforts beyond the first 2 years will require a greater level of staff support.

In addition to the high-priority items discussed above, we expect that other recommended actions will become targets of opportunity during the 2-year implementation period. If so, their implementation should be encouraged so long as it does not distract Caltrans management, the governor's office, and the legislature from completing the high-priority items. We also note that downgrading the high-priority items that we have identified in favor of others will diffuse focus, confuse stakeholders, and permit delays and deletions. The message this downgrading could transmit to Caltrans is that business as usual is acceptable.

Implementation Responsibility

Implementation requires that several decisions be made, including the determination of which actions are critical, a timeline for undertaking the actions, and the appointment of an agent or agents responsible for and capable of assessing whether the agreed-on action is indeed being

undertaken in a timely manner. The critical actions and timeline have already been described; this section addresses implementation responsibilities.

This study has been conducted in response to legislative direction; primary implementation responsibility therefore rests with the legislature. Many of the changes proposed actually require its concurrence and/or that of the governor. Caltrans will likely implement some of the recommendations as improved management practices without outside influence; MIS enhancements and selected changes to project delivery procedures fall into this category. Caltrans cannot, however, implement other changes such as those related to contracting out and the establishment of performance measures and incentives without outside support, because they will require enabling statutory changes.

The first step in implementing SRI's recommendations is to develop a consensus that these changes are necessary and appropriate. Major responsibility for this consensus rests with the senate and assembly transportation committees, with support from the governor's office. Other committees may have to become involved as questions of employee performance evaluations, compensation, and incentives are debated. We understand that the lead on the question of agency structure would be the governor's office.

We anticipate that hearings will be required to develop a consensus for the recommended changes and to allow the dissenters to argue their case before the cognizant legislative committees. Once hearings are completed, the committees will then decide which recommendations are to be implemented and the time schedule for these actions. Additional legislative action (such as a constitutional amendment to permit expanded use of contracting out) would be referred to the appropriate committees for further review and action.

Those changes that are administrative in nature can be reviewed with Caltrans management and a schedule adopted for their implementation. Changes that require further clarifications of necessary steps and changes will need to be explored by Caltrans' task forces, and detailed implementation requirements will need to be developed (including time and cost). In either event, an entity responsible for providing monitoring and follow-up to the legislative committees needs to be designated.

Monitoring and follow-up can occur by requiring Caltrans management (and any other responsible parties) to report directly to the legislative committees on an annual basis or to an intermediary who in turn provides a comprehensive report to the legislature on the progress of the plan's various elements. We believe that either the CTC or the LAO could serve as the intermediary for this review of progress and reporting.

If, after a 2- to 3-year period, progress toward implementing the recommendations endorsed by the legislature has stalled, however, then the question of whether incremental improvements of the sort described are realistic in the Caltrans culture needs to be addressed. If this lack of progress should prevail, then we recommend that an alternative implementation plan be pursued.

Alternative Implementation Plan

Our review of studies of Caltrans identified eight audits conducted in the past 20 years proposing solutions to issues more or less similar to those raised in SRI's audit. These are in addition to CTC's ongoing reviews of and comments on Caltrans' performance. Several have produced limited results, such as improved programming procedures and the introduction of